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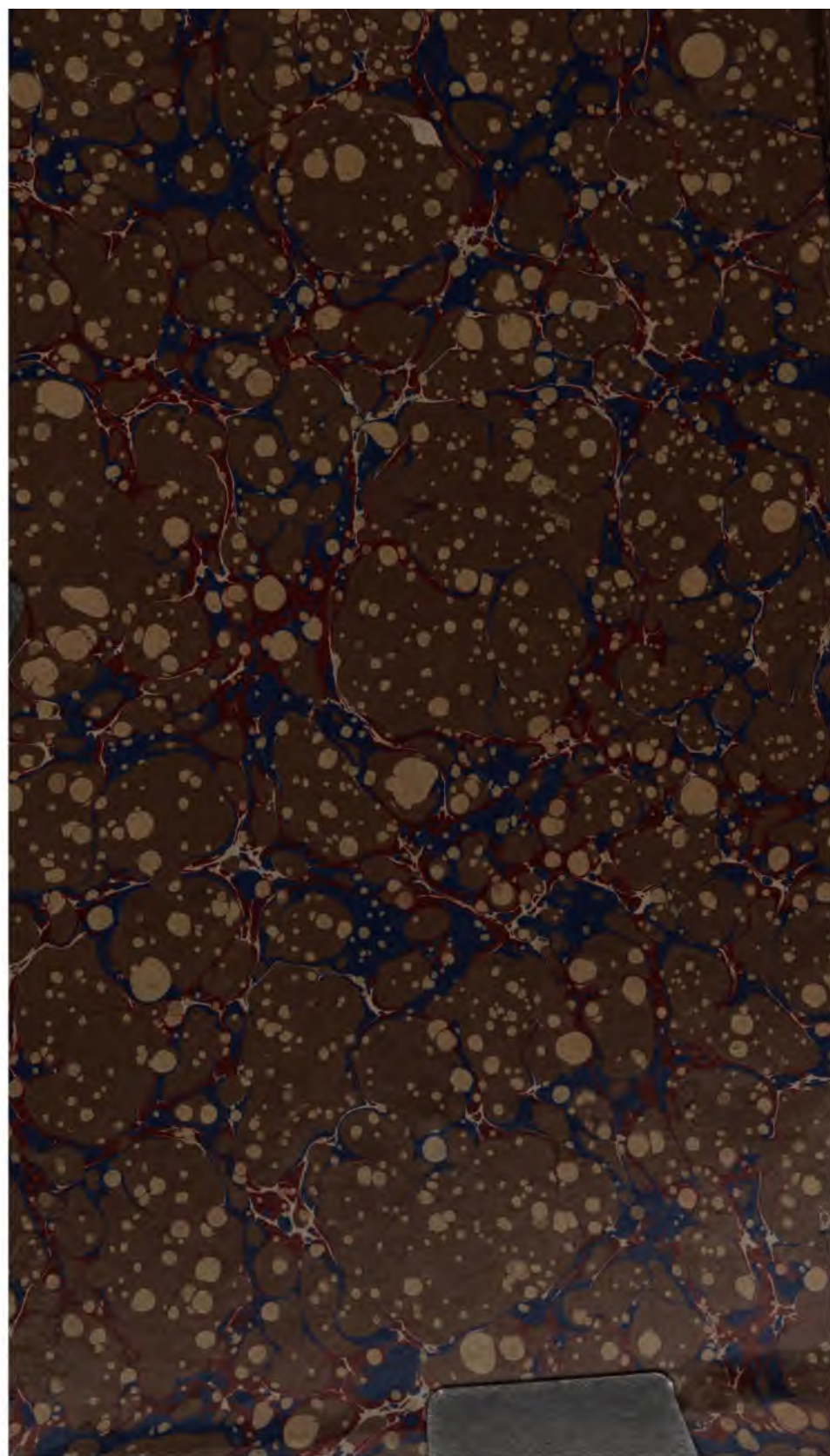
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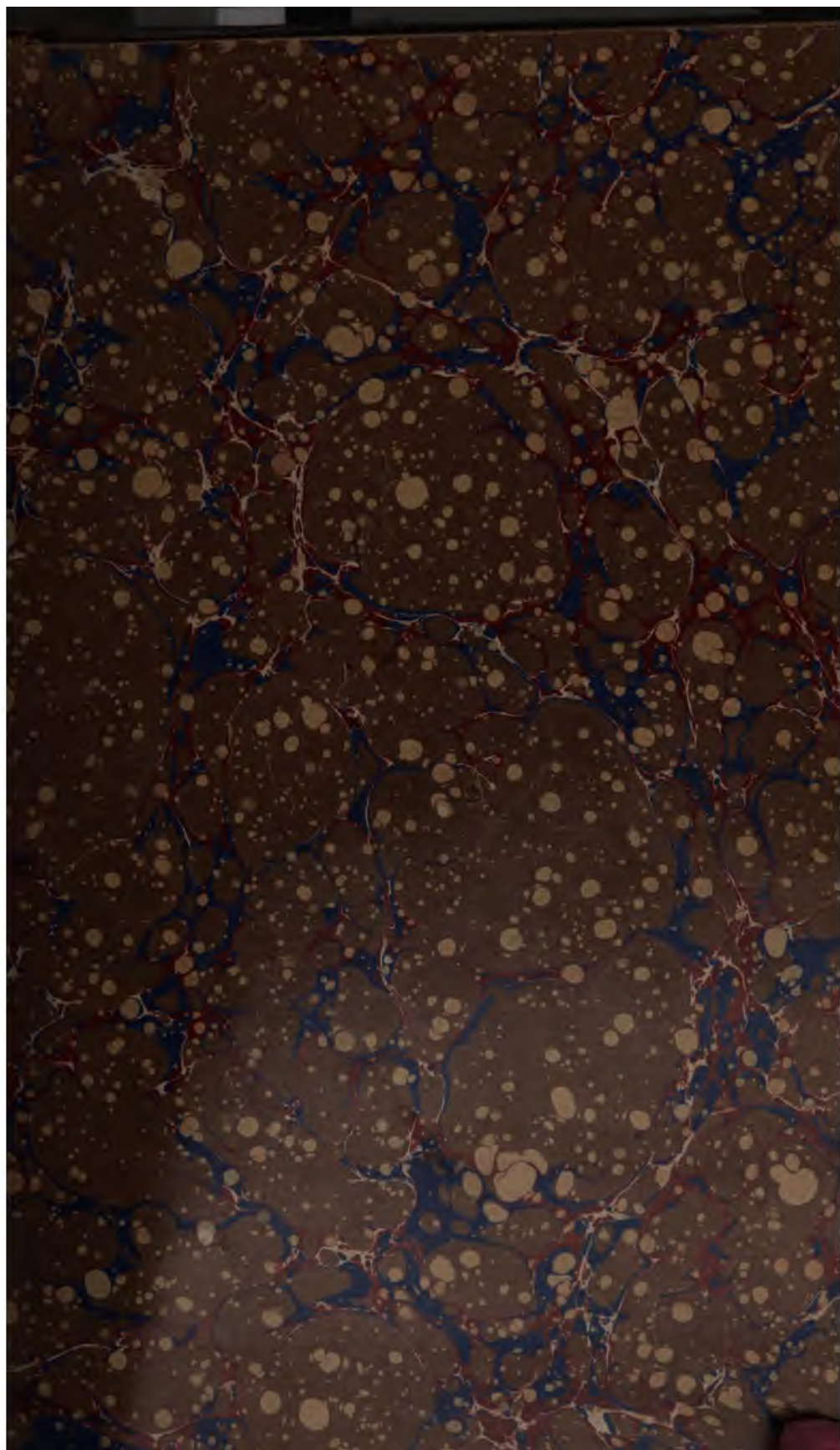
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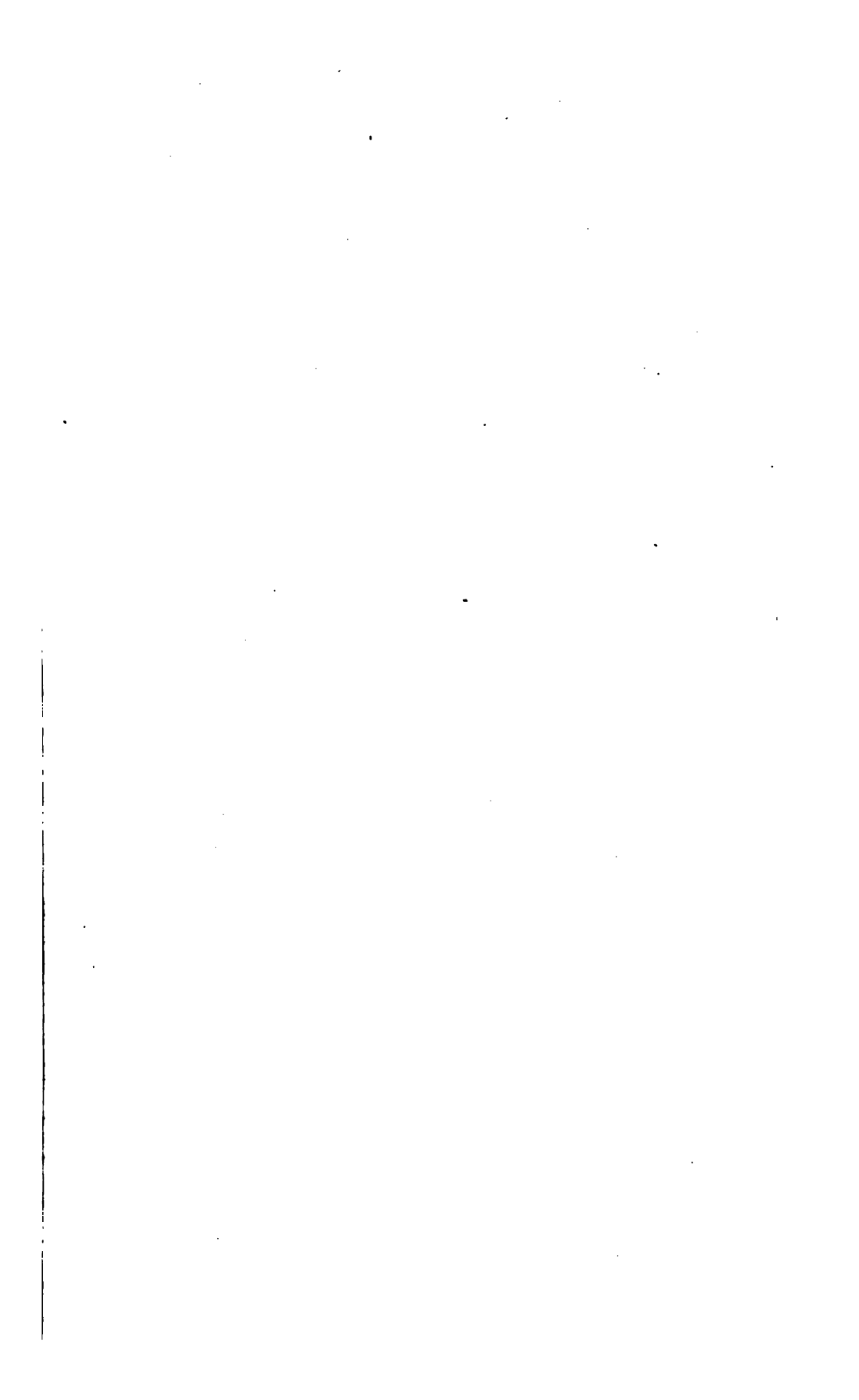
















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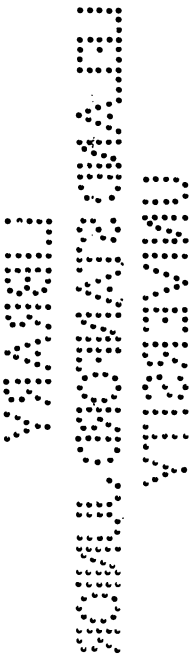
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Class I, **HEXAPODA.**

Order II, **COLEOPTERA.**

**THE NORTH AMERICAN SPECIES OF COTALPA.**

By H. F. WICKHAM,  
IOWA CITY, IOWA.

Six species of *Cotalpa* have thus far been described from the United States, and two from Central America. None are known to occur south of Guatemala, nor does the genus appear in the Old World. Our species have been described at divers times, and while the genus has been tabulated twice by Dr. Horn, neither of his synopses is complete as to species and the discovery of a seventh form seems to indicate that a new table would not be out of place.

It will be noticed that our species divide readily into two series, according to the punctuation of the pronotum and the presence or absence of long hair on the upper surface of the body. This offers a convenient and apparently natural basis for primary division, much more readily appreciable than the structure of the mandibles and of the mentum, though these points are extremely useful in separating the species in later analysis. In fact, the species of *Cotalpa* are more easily recognized by direct comparison than by description, the differences in form being difficult of exact verbal diagnosis. The following scheme will serve for their recognition.

- A. Prothorax finely punctured, body above not hairy.
  - b. Head, pronotum and scutellum distinctly metallic, under surface and legs also with metallic reflections. Elytra yellowish.
  - c. Form more elongate. Outer edge of mandible nearly straight, inner apical angle with broad deflexed tooth, .80-.90 in. *consobrina* Horn.

cc. Form robust, outer edge of mandible broadly rounded.

Elytral punctuation fine, mostly well separated, .80-1.08 in.

*lanigera* Linn.

Elytral punctuation coarse and crowded, extensively confluent transversely, .68-.75 in.

*subcristata* n. sp.

bb. Yellowish or testaceous above, with no metallic lustre; under surface piceous black, .90-1.00 in.

*flavida* Horn.

AA. Prothorax very coarsely punctured, body above hairy.

d. Prothorax very densely and confluent punctured, the hairs of this part very long, fine and abundant, .56-.72 in.

*granicollis* Hald.

dd. Prothorax deeply and coarsely but not conspicuously confluent punctured.

Larger (.85 in.). Mentum deeply emarginate.

*puncticollis* Lec.

Smaller (.52-.62 in.). Mentum rather feebly emarginate.

*ursina* Horn.

*C. consobrina* Horn, Trans. Amer. Ent. Soc., III, 1871, p. 337. Readily distinguished at sight from our other glabrous species, by the more elongate form of the body. The original specimens came from Fort Whipple, Arizona, but it is now known from several other points in the southern part of that Territory. I have taken it in numbers at light in Phoenix and Nogales, and in still greater abundance at Tucson, where it swarms about the arc-lights by the hundred. During the day I have met with it clinging to the smaller twigs of the "palo verde" on the hills near Tucson.

*C. lanigera* Linnæus, Systema Naturæ (Edit. X), 1760, p. 350. This common species occurs from Kansas eastward and exhibits considerable variation in size and in punctuation; the greater measurement cited in the table is taken from a specimen secured at Bayfield, Wisconsin, in which the sides of the prothorax are more rapidly and less arcuately narrowed behind than usual. This individual has the sides of the elytra subangulate, with a well marked tubercle in the angulation, like the females of *C. flavida*. Dr. Harris (Insects Injurious to Vegetation, p. 25) says that *C. lanigera* attacks the leaves of the pear, elm, hickory, poplar and probably other trees. It is frequently attracted to lights.

A curious variety of this species, with the label Prescott, Arizona, has been loaned me by Mr. Chas. Fuchs. While it has all the essential characters of *C. lanigera*, it is colored in such a manner as to present a totally different appearance. The metallic lustre of the head and thorax is more pronounced, the pronotum broadly brownish at the sides; the elytra are ornamented by a common brown sutural



stripe, extending the entire length, narrower at apex and extending along the basal margins to the humeri where it is recurved, giving somewhat the appearance of a broad T. I propose for it the name *Cotalpa tau*.

*C. subcribata* n. sp. Form robust, as in *C. lanigera*. Above yellowish, head, pronotum and scutellum greenish with metallic reflections, pronotal margin dark green. Head densely, confluent punctured in the region of the clypeal suture, the punctures growing sparser towards the occiput, which is smooth and polished. Clypeus slightly transversely convex, margin narrowly reflexed, angles broadly rounded, front edge nearly straight, surface densely and somewhat confluent punctured. Mentum emarginate anteriorly, the lower face with two obtusely elevated ridges arising near the front angles and converging posteriorly. Terminal joint of maxillary palpi deeply impressed. Pronotum a little less than twice as broad as long, widest near the middle, base broader than apex, sides arcuate, not angulate, surface polished and with double punctuation; the larger punctures are distant and fairly uniformly distributed except near the sides, where they become crowded, the fine ones following the same general plan. The side margins thus acquire a rugulose appearance. Median line vague, visible only in certain lights. Scutellum green, rather coarsely punctured, more densely near the base. Elytra dull yellowish, not metallic, strongly, closely and subconfluent punctate over their entire surface. Body beneath dark green, shining, more or less metallic, thickly punctured and hairy, the middle of the abdomen less densely clothed than the rest. Legs yellow with metallic green reflections, tarsi darker. Length, .68-.75 inch.

This form is most nearly allied to *C. lanigera* Linn., but presents a very different appearance on account of the coarse and close punctuation of the elytra and the much smaller size. My specimens are all females, one of them showing the subangulate elytral margin with accompanying tubercle which is so well marked in *C. flavida* (and which occurs less frequently in *C. lanigera*) while in the other two this structure is wanting.

Described from three specimens taken by Mr. Warren Knaus at Medora, Kansas, in July. In response to inquiry, Mr. Knaus writes me that all of his specimens from southwestern Kansas agree in the small size and strong punctuation so characteristic of this insect.

*C. flavida* Horn, Trans. Amer. Ent. Soc., VII, 1878, p. 53. Of

the size and general appearance of *C. lanigera*, but easily separated by the lack of metallic lustre and the much stouter legs. Described from specimens taken by Dr. Palmer, at St. George, Utah. I have since collected it at the same place, in June. A good series, taken on willows at Green River, Utah, by Professor Arthur G. Smith, is also in my cabinet. Mr. Fuchs has sent me one from Prescott, Arizona.

*C. granicollis* Haldeman, Stansbury's Explorations and Surveys of Great Salt Lake, 1852, p. 374. The prothorax is brilliant green, and the extremely coarse, close, confluent punctuation gives it a scabrous appearance. The elytra are reddish brown, very hairy. Originally described from the valley of Great Salt Lake, but specimens are in my collection from northern Colorado, Nevada (Verdi), and Washington, (North Yakima). The Death Valley expedition took it in the Argus Mountains.

*C. puncticollis* LeConte, Smithsonian Misc. Coll., 167, 1863, p. 78. Described from New Mexico, whence I have a specimen loaned by Mr. Fuchs. Mr. Liebeck has examined the series in the Horn collection, and writes that the set contains six specimens from Arizona, besides the presumptive type from New Mexico. Some of these specimens have the elytra dark while in the others they are greenish yellow. The prothorax is bright green. The thoracic punctures are umbilicate, of irregular size and closely placed, though not confluent to the extent seen in the preceding species, and the hairs are coarse and sparse. The hairs of the elytra are also coarse and easily removed; they are arranged in comparatively regular series along the suture, the outer margin and the three discal costæ.

*C. ursina* Horn, Trans. Amer. Ent. Soc., I, 1867, p. 168. The smallest species of the genus, easily recognized by the deeply but not confluent punctured blue-black or greenish black prothorax and reddish elytra. It is a plumper form than *C. granicollis*. Occurs at various points in California and the Peninsula. According to Professor Fall, it flies by day and may sometimes be seen in quantities, clinging to cypress hedges.

## THE DEVELOPMENT OF WINGS OF CERTAIN BEETLES, AND SOME STUDIES OF THE ORIGIN OF THE WINGS OF INSECTS.

BY P. B. POWELL.

STANFORD UNIVERSITY, CALIF.

(Continued from Vol. XII, page 243.)

The downward growth of the wing continues until early in the prepupal period, when it reaches the base of the leg bud, which prevents further growth in this direction (Figs. 8, 21). The wing now exists as a double-walled pad lying between the hypoderm and cuticle, extending downward and backward, as far as the base of the leg and with the basement membranes of the two layers usually closely pressed together, except at the places where tracheæ have entered the wing, forming vein cavities. The nuclei of the two walls still lie at several different planes and the outer (upper) wall is somewhat the thicker, while the bases of the cells are abruptly narrowed and thread-like.

The later stages in the development of the wings of *T. plastrographus* and of *D. valens* are very much as have been described by various authors for the Coleoptera and Lepidoptera. With the beginning of the prepupal period the growth of the wing becomes accelerated. With the lengthening of the wing the nuclei begin to be drawn up into one row near the outer ends of the cells, while the cells themselves become very much elongated and drawn out in places (Figs. 9, 10). Shortly before pupation this process becomes completed and the cells have the characteristic "fringed" appearance of the pupal hypodermis described by Verson (1904). The wing is now greatly wrinkled and folded, the vein cavities are greatly enlarged and filled with hæmolymp and leucocytes, both of which also circulate in the spaces between the elongated cells. The basement membrane, which throughout the development of the wing is very thin and not easily discernable, becomes more or less degenerated during the prepupal period and in places the bases of the cells either end free (Fig. 19), or become fused and anastomosed with each other (Figs. 11, 22).

Early in the last stage there is secreted all around the body, underneath the dense outer chitin, an inner layer of soft spongy or stringy

chitin which takes a faint stain with hæmatoxylin. This chitin is especially pronounced around the wing buds, which it entirely surrounds, at first more or less completely filling the cavity between the wing and the hypodermis.

(d) *Formation of the Veins.* — At about the beginning of the prepupal period, or shortly before, the vein cavities begin to be formed. Several branches arise from the trachea at the base of the wing and push into the wing pad, the two layers of the basement membrane separating as the trachea enters (Fig. 38). At the same time that the tracheæ enter the wing the tracheoles uncoil and accompany the tracheæ. This manner of the formation of the veins, which I have observed in *T. plastographus* and *D. valens* and also in *Bruchus* sp. and the Pepper beetle, differs from the account of Tower, who found that the cavities were formed before the tracheæ develop and enter the wing, whereas, so far as I have been able to observe, the development of the two is coincident.

### 3. THE TRACHEAL SYSTEM.

According to Comstock and Needham, working on *Hippodamia 13-punctata*, there are in the wings of Coleoptera, as has been so often shown to be the case in the Lepidoptera, two systems of tracheation, a temporary system of tracheoles, and the permanent wing tracheæ, which develop after entering the wing a system of tracheoles of their own; the temporary system of tracheoles being much less highly developed than in the Lepidoptera. The permanent tracheæ enter the wing during the last larval stage, when the wing is well developed and at the beginning of its rapid extension.

While they found the two distinct systems in the Coleoptera, they found that in wings developing externally like those of a dragon-fly, "the principal tracheæ pass out very early into the wing bud, branching freely and forming by multitudinous terminal anastomoses a network of capillary tracheoles," no temporary tracheoles being found. They believe that the development of the latter is due to and depends on the confinement of the wing within narrow quarters inside the body and to its small size. Their observations on the Coleoptera were corroborated by the researches of Tower. I have found evidence leading me to the conclusion that there is no fundamental difference between the development of the tracheoles and that of the tracheæ, but that the two systems merge into one another. I will reserve this, however, for a later communication.

(a) *The Tracheoles*. — In all the larvæ that I have examined there is from the very beginning a close connection between the wings and the tracheal system. Comstock and Needham found (in *Hippodamia 13-punctata*) that the wing fundament had at first "no connection with or approximation to any trachea," this connection not occurring until the wing disc had invaginated well into the body, approaching a lateral tracheal trunk, and evagination had begun. Needham found that in *Mononychus vulpeculus* the wing bud differed from the leg bud only in having no tracheæ at or near its inner surface. This I think is an unusual condition and not to be found in many Coleoptera. In all the Coleopterous larvæ examined by Tower (1903), even in the earliest stages the wing fundament received a distinct branch from the tracheal trunk; a similar condition was found in the Lepidoptera by Mercer (1900).

In the earliest stages of the wing, in *T. plastographus* and *D. valens* and in a Buprestid, even before the fundament becomes recognizable in some specimens, two branches extend from the tracheal trunk to the hypodermis at the place where the wing fundament is shortly to arise. Sections of larvæ taken at this time show the tips of these tracheal branches abutting directly against the bases of the cells of the newly forming wing, the tracheal cells proliferating and spreading out over the inner face of the disc. A mass of cells is thus formed, the walls of which are either very thin or more or less degenerated and in this mass of cytoplasm and nuclei, forming tracheoles are to be seen (Figs. 2, 3, 23). In some cases (*T. plastographus*) the tip of the tracheal branch, when it touches the wing disc, apparently pierces the basement membrane (Fig. 5) and then spreads out directly against the bases of the cells of the disc as a mass of cells, in the cytoplasm of which tracheoles are developed as fine somewhat coiled tubes (Figs. 5, 6). In other specimens the basement membrane apparently degenerates so that the bases of the cells of the disc are free. I have seen this in *D. valens* (Fig. 23). Occasionally the tracheæ push into the disc so that they are nearly surrounded by the cells of the latter (Fig. 1). Fig. 5 (*T. plastographus*) is a section through the disc of the fore wing near its cephalic margin, just after the last moult and shows a tracheal branch pushing through the basement membrane and spreading out under it.

My observations confirm those of Tower and Mercer that the tracheoles are formed from the cytoplasm of the tracheal cells and not

from their nuclei. The manner of development of the tracheoles is the same in all the beetles examined. Figs. 3 and 23 show an early stage in their development. From these figures it will be seen that they are formed as long curved and coiled tubes. As the cytoplasm of the tracheal cells becomes used up in their development, these tubes become looped around the nuclei and by the time that the wing is well evaginated the greater part of the cytoplasm of the cells has been used up and we find a mass of large tracheoles looped and coiled around the nuclei (Fig. 7), nearly every nucleus being closely enfolded by a tracheole.

The tracheoles are present throughout the larval development of the wing and probably degenerate some time during the pupal period. Fig. 17 shows a bundle of tracheoles extending into the base of a wing in the prepupal period. Figs. 13, 15 and 16 show tracheoles that have developed from the wing tracheæ after their entrance into the wing. I have not observed the earliest stages of the formation of these secondary tracheoles, but it will be seen from these figures, which were drawn from the same wing as Fig. 17, that there is no difference in the structure of the primary and the secondary tracheoles. In fact the two cannot be distinguished when in the wing.

The simplest condition of the tracheoles was found by Tower to be in *Coccinella bipunctata*, in which a few tubules developed from the tracheal trunk at irregular intervals, while the most specialized condition was found in the Buprestidæ. My observations confirm those of Tower that the most specialized condition of the tracheoles is to be found in the Buprestidæ, but I find, however, that as in *T. plastrographus* and *D. valens*, the tracheoles begin to develop as soon as the wing disc, and are fully formed, as a mass of tubes which are very small next the wing disc, becoming larger further out, by the time that the wing begins to evaginate (Fig. 19).

The tracheoles in the Coleoptera are of a simpler type than is found in the Lepidoptera as described by Gonin (1894), Mercer (1900) and others. Mercer found the tracheoles beginning to develop during the fourth larval stage and becoming functional after the next moult, at the beginning of the last stage. In the Coleoptera, according to Tower, they do not begin to develop until the wing is well formed, during the last larval stage, becoming functional early in the prepupal period and without a moult. I have not been able absolutely to determine the time of their becoming functional in the bee-

tles worked on, but it seems certain that they do so at an early stage in the development of the wing, probably at the moult preceding the evagination of the wing, and their main purpose is to supply the disc with an abundance of air at this important stage of its development.

(b) *The Tracheæ of the Wing.* — Shortly before the beginning of the prepupal period, several branches arise from the main trachea and push into the wing, extending nearly to its margin. These are the permanent wing tracheæ, and they are accompanied into the wing by the tracheoles, which begin to uncoil at this time. These tracheæ correspond in number and general position to the veins of the pupal and adult wing, and their early development, taking place soon after the evagination of the wing begins, is similar to what occurs in the wings of Heterometabolous nymphs. According to Comstock and Needham, "in wings developing externally like those of a dragon-fly one sees the principal tracheæ passing very early out into the wing bud, branching freely and forming by multitudinous terminal anastomoses a network of capillary tracheoles. In the beetle wing these fine tracheæ and tracheoles follow rather closely the course of the vein cavities, and are most readily seen by an external examination of the wing just after pupation.

### III. THE ORIGIN OF THE WINGS.

The question of the origin of the wings of insects is one over which there has been much controversy. In all insects the wings first become recognizable as slight thickenings of the hypodermis in the pleural region near the place where the suture arises between the dorsum and the pleurum, but whether they have been modified from some other structure or have been developed as entirely new structures is uncertain.

There have been three theories advanced to account for the origin of the wings of insects:

1. That they have been developed from tracheal gills.
2. That they have arisen as lateral outgrowths of the tergum or pleurum of their respective segments.
3. That they arise from degenerated spiracle discs of the meso- and metathorax.

The theory that the wings of insects have arisen from tracheal gills was first advanced by Gegenbauer and adopted by Lubbock and has since been advocated by Pratt (1897). This theory, of course,

presupposes that the ancestors of the winged insects were aquatic forms and that still farther back in the line of descent the pregenitors of these aquatic forms must have been terrestrial, in order to have evolved a tracheal system in the body, from which later, tracheal gills could be developed; as otherwise, if gills had been developed at all by these primitive insects they would certainly have been blood gills.

But all the evidence points strongly to the supposition that the ancestors of the winged insects were terrestrial. It has been shown by Packard (1898) that tracheal gills are adaptive, secondary, temporary larval structures that do not persist in the adult and "are not ancestral, primitive structures." Tower also rightly objects that there is no resemblance between the fundamental type of wing venation, as established by Comstock and Needham, and the tracheation of any known tracheal gill, which should certainly be the case if the wings had been developed from any such structure.

The second theory and the one to which it seems to me that all the present evidence points strongly is the one put forward by Graber (1867) and Muller (1875) and strongly supported by Pancritius (1884) and Packard (1898), that the wings have arisen as simple outgrowths or evaginations of the integument at the suture between the dorsum and the pleurum. After working on the development of the wings in the Termites, Muller declared that the wings of insects have been derived from lateral continuations of the dorsal plates of their respective segments.

I have shown that in the Coleoptera the wing arises on the pleurum, at or near the future position of the dorso-lateral suture, as a thickening of the body wall, which, in the simplest type, begins as a simple pushing outward and downward of this thickening (Fig. 4). In another paper I shall show exactly the same process in the beginning wing of the Neuropteran, *Raphidia* sp. the wing developing as an outpushing of the thickened hypoderm at the lateral fold. In certain Hemiptera, sections of the early stages of which I have examined, it was evident that the wing developed as a simple pushing out and folding of the body wall near the lateral suture.

All this is in line with the conclusion of Packard (1898) that "the wings are essentially simple dorsal outgrowths of the integument, being evaginations of the hypodermis," and of Comstock and Needham (1899) that the "wings arise as sack-like folds of the body wall at the point where the suture between the tergum and the pleurum



later develops. In most insects with an incomplete metamorphosis they are so directly continuous with the tergum and become so solidly chitinized with it that they have generally been interpreted as outgrowths from its caudo-lateral margin." Muller (1875) has shown that in *Calotermes* the wings arise on the meso- and on the metathorax in same position and cannot be distinguished in their early stages from the prominent lateral fold that develops on the prothorax.

In every insect, both in the Holometabola and in the Heterometabola, in which the early stages of the wing development has been investigated, it has been found that the wing arises in a homologous position on the pleurum and that in the simplest types it develops as a simple outpushing of the hypodermis. In fact, in *T. plastographus* and in *D. valens* in their early stages the wing discs are exactly like the leg discs and have a similar mass of tracheoles at their base. While it is not doubted but that the legs have been developed from folds or outpushings of the hypodermis, there is no more reason to believe that the wings have developed from spiracles or in some other circuitous manner than there is in the case of the legs.

The third theory, which was advanced by Verson (1890, 1894), is that the wings develop from the discs of the degenerated spiracles of the meso- and metathorax. This theory has been strongly supported by Tower (1903).

Wheeler (1889), working on a Chrysomelid beetle, *Leptinotarsa ro-lineata*, observed that during the development of the embryo, every segment of the thorax and abdomen develops a spiracular invagination, that these invaginations send off branches some of which unite to form the lateral tracheal trunk, that after the formation of the trunk the prothoracic spiracle closes over and disappears, which is also the case with the metathoracic spiracle, while the mesothoracic spiracle is situated near the suture between the pro- and mesothorax "and in later stages often has the appearance of belonging to the first segment." These observations were confirmed by Tower, who makes the additional statement that in the migration cephalad of the mesothoracic spiracle, "the spiracle alone migrates and the thickened area of the hypodermis remains and probably becomes the fundament of the elytron." He says that after the formation of the longitudinal tracheal trunks "the openings in the meso- and metathorax are rapidly cut off, leaving a disc-shaped mass of cells which have a somewhat concentric arrangement. The further stages in the degeneration of

these spiracles I have not been able to observe. That this rudiment of the spiracle is converted into the imaginal disc of the wing seems probable, however, for the following reasons: (1) The disc of the wing always appears in exactly the same area as that in which the spiracle arose and degenerated, (2) the wing disc frequently shows a concentric arrangement of the cells in early stages but loses this before invagination to form the wing begins, (3) if the wing fundament is not derived from the remains of the spiracle, then, since the wing disc has the exact position occupied by the spiracle, the latter must entirely degenerate and be replaced by new hypodermis, and from this the wing must arise. There is, however, absolutely no ground for belief in such a process and the only conclusion that seems at all tenable is that the wing fundament is derived directly from the remains of the spiracle." Tower states farther that these spiracle discs are quite distinct in the embryo shortly before hatching, but that soon after the larva emerges they either degenerate or subside into a quiescent period so that they are not recognizable from the surrounding hypodermis, but that after this period of rest, the cells begin to grow again and form the wing fundament.

I shall present what, I think, is conclusive evidence that the wings do not arise from discs of degenerated spiracles, but which points strongly to the supposition that the wings have originated as outpushings of the hypodermis at the suture between the pleurum and the tergum.

I have found (1) from the examination of a large number of species of Coleopterous larvæ that the mesothoracic spiracle is present in many species and that in some of these it is functional, while in others the connection with the longitudinal tracheal trunk has more or less completely degenerated but that the spiracle itself is present though considerably smaller than the other spiracles and but lightly chitinized. (2) That in the larvæ of some winged insects possessing both meso- and metathoracic spiracles these spiracles have not migrated forward to any appreciable extent, in some cases occupying exactly the same positions in their respective segments that the abdominal spiracles occupy in their segments. (3) That the wing fundament arises distinctly either above or below the positions occupied by the thoracic and abdominal spiracles. That is to say, the positions of the spiracles on the pleuræ of their respective segments varies in different insects, being in some cases distinctly below the origin of the wing and in others distinctly

above the wings, and that they generally lie in the cephalic half of their segments, while the wing fundament is centrally situated on its segment. (4) If it can be proven that in any winged insect the mesothoracic and metathoracic spiracles are present and functional, it seems certain that the wings have originated independently of the spiracles and not from any spiracle disc, since it seems pretty hard to believe, as has been stated by Tower, to be the case with the mesothoracic spiracle, that the spiracles migrate forward while the discs remain behind; that is to say, the chitinized opening alone moves forward and new hypodermal cells become specialized and take on the function of secreting the chitin of the spiracle, while the old cells (disc) remain behind and later develop into a wing.

### I. *The Spiracles.*

In the primitive insects, the ancestors of our present winged forms, a pair of spiracles was present in each of the three thoracic segments, as well as in each of the first nine abdominal segments. The presence or absence of certain of these spiracles and their position on the segments has an important bearing on the theory of the origin of the wings from spiracle discs.

While the prothoracic spiracle is present in the embryo, as has been shown by Wheeler, it entirely degenerates and is not known to be present in the larva or adult of any winged insect. In the Lepidoptera however it is said to have been transformed into the spinneret.

The mesothoracic spiracle is always present and open except in some aquatic larvæ. This spiracle has often been called the prothoracic because it has often migrated into that segment, but that it is really the mesothoracic has been proved by Wheeler (1899), whose observations have been confirmed by Tower (1903). This is usually the largest of all the spiracles, but in the aquatic forms, many of the Odonata, Ephemera and Diptera, this, as well as all the other spiracles of the body are closed or nonfunctional, reappearing as functional spiracles in the adult insect.

In the larvæ of many insects the metathoracic spiracle has entirely degenerated, but this is by no means the rule. Among the Coleoptera it has been proved by Graber (1888) for *Melolontha* and *Lina* and for *Doryphora* by Wheeler (1899) that it is present in the embryo. They found however that this spiracle degenerated before the larva emerged from the egg. Complete degeneration however

does not always take place. A careful external examination will show, in the larvæ of many beetles, that the metathoracic spiracle is present, though usually much smaller than the other spiracles and generally much less heavily chitinized, so that it is quite inconspicuous and easily overlooked and it is in many cases evidently closed or non-functional, at least during the larval state. I have found the metathoracic spiracle present in the larvæ of a Trogositid, *Thymalus marginicollis* (*fulgidus*) (Fig. 25), of a Pyrochroid sp., of an Erotylid sp. (Fig. 26), in the larvæ of several unknown Tenebrionidæ, Carabidæ and Cerambycidæ. In the larvæ of the Scolytids *T. plastographus* and *D. valens* (Figs. 32, 33) I have been unable to find the spiracle by external examination, but cross-sections of the metathorax at the place where the spiracle should be show the spiracular branch extending out from the lateral tracheal trunk entirely through the hypodermis (Fig. 12) and they are probably functional. In the larva of *Thymalus marginicollis* the metathoracic spiracle can be plainly seen as a small oval disc with a slit in it and it is probably functional (Fig. 25). Breed (1903) has figured this spiracle in both the larva and the pupa of this beetle. In the larva of the Erotylid sp. (Fig. 26) this spiracle is even larger and though considerably smaller than the other spiracles is undoubtedly functional.

In larvæ that are light colored and not heavily chitinized, such as many of the wood borers, the tracheal system can usually be well brought out by clearing in cedar oil. Fig. 24 shows the lateral tracheal system of a larva thus prepared, of a Ptinid, *Ozognathus cornutus*. It will be seen that under the metathoracic and each of the abdominal spiracles there is a tracheal center, that is, the group of tracheal branches which, in the embryo, arose from the end of each spiracular invagination and ramified in all directions. Although, on account of the small size of the larva, I could not make out with certainty a spiracular opening in the metathorax, there is a tracheal center under the spot where this spiracle should be, which is larger than any in the abdomen except the first and it is not probable that this would be the case if there were no functional opening. It will be seen that, while the mesothoracic spiracle has migrated forward into the suture, the tracheal center migrated with it, while the metathoracic tracheal center is distinctly in the metathorax and occupies nearly the same position in its segment as is occupied by the abdominal centers in their segments.

Among the Hymenoptera I have found the metathoracic spiracle present in the larvæ of the honey bee, *Apis mellifica*, of a wood-boring wasp and of an undetermined mud-wasp. In all cases this spiracle is not to be distinguished from the other spiracles of the body, either in shape, size or position.

I have also found vestiges of the metathoracic spiracle present in the larva of the silk-worm, *Bombyx mori*.

In the Neuroptera I have found the metathoracic spiracle present and open(?), though small, in the larva of *Raphidia* sp., and also in the pupa.

There are numerous references in entomological literature to two pairs of thoracic spiracles. Among the Coleoptera both meso- and metathoracic have been recorded for the larva of *Elmis* (Parnidæ) and *Lycus* (Lampyridæ) (Packard). In the Hymenoptera both pairs are present in the Aculeata and in the Siricidæ, though in the latter the metathoracic is sometimes closed. Both spiracles are also present in *Apis* and *Hylotoma* (Packard). Packard figures the larva of *Bombus* with a full-sized metathoracic spiracle and Bugnion has done the same for *Encyrtus fuscicollis*. Packard also figures a meso- as well as a metathoracic spiracle in a locust, *Melanoplus femur-rubrum*. Calvert (1893) has found that in all the adult Odonata the metathoracic spiracle is present and very distinct. In those insects, the larval stages of which are passed in the water and which develop tracheal gills (Odonata and Ephemera), thoracic gills are present and open in the early larval stages, but later become closed (Packard). Both pairs of spiracles have been shown by various authors to be present in the Hemiptera. Among the Diptera both pairs are present in the larvæ of Bibionidæ and Cecidomyidæ (Miall and Hammond). Both pairs are present in the Termites.

## 2. *The Position of the Thoracic Spiracles and their Relation to the Wing Discs.*

During embryonic life the spiracles are formed as invaginations on the pleuræ of their respective segments at a point nearly midway between the middle of the segment and the suture in front of it. This embryonic position of the spiracles can be readily seen by reference to the figures of Graber (1891) who worked on the embryonic stages of the Lepidoptera, Coleoptera and Orthoptera and the figures of Wheeler (1889) for the Coleoptera. The mesothoracic spiracle often migrates

forward so that in the larva it lies in the suture or even in the prothorax. This is especially true of the Lepidoptera. The metathoracic spiracle, when present, sometimes migrates forward as far as the suture, while the abdominal spiracles as a rule, remain very nearly in their embryonic positions.

In the Coleoptera the mesothoracic spiracle usually lies in or near the suture between the pro- and mesothorax (Figs. 24, 25), but in many cases it is distinctly in the mesothorax and in some species there is little or no migration (Fig. 26). Its position corresponds very nearly to that of the mesothoracic (Figs. 25, 26), but I have never found it entirely in the mesothorax.

The height at which the spiracles are situated on the pleurum is a little below the place where, later, the suture is formed between the dorsum and the pleurum and is always distinctly below the wing discs (Fig. 31). The latter arise near the future sutural line and are always centrally situated on their segments, while the spiracles lie in the front part. Their relative positions can be determined by certain muscles occurring in each segment. In certain Hymenoptera, however, the spiracles are situated at some distance above the wing discs.

Vestiges of the metathoracic spiracle are to be found in the larvæ of some Lepidoptera. An external examination of the silk-worm (*B. mori*) will reveal the remains of this spiracle as a small, oval, faintly-chitinized ring, occupying a position on the pleurum of the metathorax near the suture between that segment and the mesothorax and in a position very nearly corresponding to that of the first abdominal spiracle on its segment, as will be seen by reference to Fig. 27 (drawn from a larva killed after the second moult and cleared in cedar oil). This shows the lateral tracheal system of the thoracic and first abdominal segment and the forming wing buds. It will be seen that the latter are centrally situated on the sides of their respective segments and dorsad of the longitudinal tracheal trunk. A small tracheal branch arising near the first abdominal spiracle pushes forward to the metathoracic wing disc, where it is met and joined by another small branch arising near the metathoracic spiracle. Two tracheæ arising similarly, near the meso- and metathoracic spiracles respectively, join at the center of the mesothoracic wing disc (Fig. 27). These two tracheal branches probably give rise, the one to the radio-medial and the other to the costo-anal groups of wing tracheæ. It is evident from the position of these wing discs that they have not arisen from any

part of the spiracles. The metathoracic wing disc is not situated over the tracheal center of its segment, while the remains of the metathoracic spiracle does lie over this center. The mesothoracic spiracle has migrated forward into the prothorax, but it is evident that not only the opening but the spiracular disc, as well as the tracheal center have migrated forward. Moreover, the metathoracic spiracle has not migrated, or at least very slightly, as will be seen by comparing its position with that of the first abdominal spiracle; so that it is not possible that either the meso- or metathoracic wing should have arisen from any part of a spiracle.

While, among many of the orders of insects, the metathoracic spiracle is in a more or less vestigial condition, being either considerable smaller, or entirely degenerated, it is to be found in the Hymenoptera, full sized and perfectly formed. In this order the positions of the wings and the spiracles in respect to one another are different from anything that I have found in any of the other orders. In the larva of the honey-bee (*Apis mellifica*) the metathoracic spiracle is as large as any of the other spiracles and cannot be distinguished from them in shape. The meso- and metathoracic spiracles and the abdominal as well occupy positions on the pleurum near the front margin of their respective segments, while the wings are centrally situated on their segments and arise considerably below the spiracles, as may be seen by reference to Figs. 28, 29. This is just the reverse of their position in the Coleoptera and Lepidoptera, in which, I have shown (Fig. 27), the wing discs are distinctly above a line drawn through the spiracles, while in *Apis*, the base of the wing bud is below the spiracles, at about one third the distance between them and the leg buds (Figs. 28, 29). This can be easily seen by an external examination of the larva, as the wing and leg buds lie outside the hypodermis, next the cuticle and can be readily seen through it. The tracheal centers under each spiracle are greatly reduced, there being only a few small branches which soon break up into a fine network of small tracheæ or tracheoles. We find in *Apis*, just as we did in the Silkworm, a small trachea running from the tracheal center behind each wing bud and meeting at the base of the bud a similar trachea coming from the tracheal center in front of the wing. I believe this will be found true of all winged insects, while from these two tracheæ evidently develop, respectively, the two groups of wing tracheæ.

## V. CONCLUSION.

It has been shown in this paper that among the Coleoptera are to be found examples of the simplest type of wing development known to occur in the Holometabola, while this type differs from the development of the wings in the Heterometabola mainly in that it is held closely to the side of the body until pupation, and that in the Scolytidæ and in certain Bruchidæ and Buprestidæ, the development of the wing takes place without any preliminary invagination of the center of the disc or recession from the cuticle. It has been shown, also, that there is a distinct system of tracheoles developed at the base of the wing, the first appearance of which is coincident with the forming of the wing disc, and that these tracheoles cannot be distinguished from those that arise within the wing from the permanent tracheæ, during the prepupal period.

I have shown conclusively that the wings do not arise from any part of the spiracles of the mesothorax or metathorax, nor do the spiracles and the wings arise from the same place on the pleurum, even in those insects in which the metathoracic spiracle degenerates. But that the spiracles arise in the embryo in a different position from that in which the wings arise, while in many insects the metathoracic spiracle does not degenerate.

In those insects possessing tracheal gills, these gills are developed in larval or pupal life and are temporary, adaptive structures that do not persist in the adult, while there is no evidence whatever to show that the wings have been derived from any such structure possessed by the ancestors of the winged insects.

On the other hand, the only conclusion that seems at all reasonable, and the one to which the earliest stages in the formation of the wing in all insects seems to point, is, that the wings have been derived as lateral outgrowths or folds of the hypodermis of the pleurum or tergum, or both.

## METHODS.

In preparing the material for these investigations several different methods were tried. Among the fixing solutions, the best results were obtained with a saturated solution of corrosive sublimate in ten per cent. formalin, washed out with four per cent. formalin. Very good results were also obtained by the use of Tower's No. 3, the formula for which is as follows :



Sat. sol. HgCl <sub>2</sub> in 35 per cent. alc. . . . .	60 vols.
Glacial acetic acid (99.5 per cent.) . . . . .	10 "
Platinic chloride 2 per cent. sol. in aq. dest. . . . .	30 "

This can be used either warm or cold, while the material should be cut into as small pieces as possible.

Out of a number of different stains tried, I selected Ehrlich's acid hæmatoxylin as the best all round stain for the wings and other hypodermal tissues, though Delafield's hæmatoxylin gave good results and iron hæmatoxylin worked well in some cases.

#### EXPLANATION OF PLATES XI-XVII, VOL. XII.

All the figures used in this paper were outlined with a camera lucida and the details put in with free hand. The figures are arranged dorsal side up, and the anterior surface toward the reader.

Abbreviations used in the figures :

<i>b</i> , basement membrane.	<i>s</i> <sub>1</sub> , mesothoracic spiracle.
<i>c</i> , head.	<i>s</i> <sub>2</sub> , metathoracic spiracle.
<i>ct</i> <sub>1</sub> , old cuticle.	<i>s</i> <sub>3</sub> , first abdominal spiracle.
<i>ct</i> <sub>2</sub> , new cuticle.	<i>s</i> <sub>8</sub> , last abdominal spiracle.
<i>ct</i> <sub>3</sub> , secondary cuticle.	<i>set</i> , seta.
<i>f.b</i> , fat body.	<i>tr</i> , trachea.
<i>h</i> , hypodermis.	<i>tr.cl</i> , tracheal cells.
<i>h.sp</i> , spur of hypodermis.	<i>tr.ol</i> , tracheole.
<i>l.b</i> , leg bud.	<i>tr.ol.w</i> , wing tracheole.
<i>le'cy</i> , leucocyte.	<i>tr.cr</i> , tracheal center.
<i>l.tr</i> , lateral tracheal trunk.	<i>w.d</i> , wing disc.
<i>ms</i> , muscle.	<i>w.b</i> , wing bud.
<i>nc</i> , nucleus.	<i>w.l</i> , wing lumen.

Fig. 1. *Tomicus plastographus*. Just starting wing disc, showing tracheæ partly surrounded by cells of the disc. From cross-section of larva in the middle of the second stage.

Fig. 2. *T. plastographus*. Not quite frontal sagittal section of wing disc, showing forming tracheoles at base of disc. From larva in middle of second stage.

Fig. 3. *T. plastographus*. Wing disc, showing the pronounced folding and ridging of the cells. From cross section of larva just before second moult.

Fig. 4. *T. plastographus*. Wing disc just beginning to evaginate. From cross section of larva soon after second moult.

Fig. 5. *T. plastographus*. Cross-section of wing near cephalic end, showing trachea pushing through basement membrane, the cells spreading out underneath it and tracheoles beginning to form. From larva just after second moult.

Fig. 6. *T. plastographus*. Cross-section through middle of same wing from which Fig. 5 was taken, showing forming tracheoles and the bases of the cells beginning to elongate and separate.

Fig. 7. *T. plastographus*. Cross-section of wing well evaginated, showing thread-like bases of cells and tracheoles well developed.

Fig. 8. *T. plastographus*. Cross-section of wing through a vein cavity, showing wing extending to base of leg bud.

Fig. 9. *T. plastographus*. Cross-section of wing, showing beginning of folding of wing and the pulling of the nuclei into one row. Tracheæ and tracheoles in the vein cavities.

Fig. 10. *T. plastographus*. Cross-section of part of wing from same larva as Fig. 9, showing elongated bases of cells and tracheæ and tracheoles in vein cavity.

Fig. 11. *T. plastographus*. Full grown wing, shortly before pupation.

Fig. 12. *T. plastographus*. Cross-section through the metathoracic spiracle. (The cuticle was pulled away from the hypodermis during sectioning.)

Fig. 13. *T. plastographus*. Tracheole from full grown wing.

Fig. 14. *T. plastographus*. Tracheoles formed around the nuclei, from base of wing just before second moult.

Figs. 15 and 16. *T. plastographus*. Tracheoles from prepupal wing.

Fig. 17. *T. plastographus*. Bundle of tracheoles entering wing. From larva in prepupal period.

Fig. 18. Just starting wing disc of a Buprestid.

Fig. 19. Wing disc just beginning to evaginate, showing great proliferation of tracheoles. From same Buprestid as Fig. 18.

Fig. 20. *Bruchus* sp. Cross-section of wing well evaginated, showing trachea in vein cavity and the thick walls of the wing bud.

Fig. 21. *Bruchus* sp. Wing at a later stage than Fig. 20. The basement membrane has nearly degenerated.

Fig. 22. *Dendroctonus valens*. Full-grown wing shortly before pupation.

Fig. 23. *D. valens*. Forming wing disc, just before last moult, showing folding of the disc and the tracheoles at base.

Fig. 24. *Osoenathus cornutus*. Lateral tracheal system from a larva cleared in cedar oil.

Fig. 25. *Thymalus marginicollis* Chev. Lateral view of front part of body of a full-grown larva, showing metathoracic spiracle.

Fig. 26. Lateral view of meso- and metathorax of a larva of an Erotylid, showing meso- and metathoracic spiracles and their positions.

Fig. 27. *Bombyx mori*. Lateral view of larva just after second moult, cleared in cedar oil, showing lateral tracheal system of thorax, the vestiges of the metathoracic spiracle and the wing discs.

Fig. 28. *Apis mellifica*. Lateral view of head, thorax and first abdominal segment, showing the leg and wing buds as seen through the cuticle, and their relation to the spiracles. From larva one half grown, cleared in cedar oil.

Fig. 29. *Apis mellifica*. Larva (prepupal period early) showing relative positions of spiracles and wing buds, as seen through the cuticle.

Fig. 30. From same larva as Fig. 29. Ventral view showing wing and leg buds.

Fig. 31. *Tomicus plastographus*. A not quite cross-section of a larva just before last moult, showing hinder margin of metathoracic wing disc and part of first abdominal spiracular trunk, to illustrate the relative heights on the pleurum of the spiracles and wing discs.

Fig. 32. *T. plastographus*. Full grown larva; side view.

Fig. 33. *Dendroctonus valens*. Larva; side view.

Fig. 36. *Dendroctonus valens*. Cross-section of wing disc, showing an early stage of the evagination.

Figs. 34, 35 and 37. *Tomicus plastographus*. Early stages in the evagination of the wing.

Fig. 38. *T. plastographus*. Cross-section of wing bud showing thread-like bases of the cells and a trachea pushing into the wing. From larva at about the beginning of the prepupal period.

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## Class I, HEXAPODA.

### Order IV, DIPTERA.

## A SYNOPTIC TABLE OF NORTH AMERICAN MOSQUITO LARVÆ.

BY HARRISON G. DYAR, A.M., Ph.D.,

WASHINGTON, D. C.

I have had this table in hand for over a year, but have been dissuaded from printing it by Dr. Howard, who advised delay on the ground that new forms were continually being found. Now, however, we have at hand all the larvæ of the known species of the Atlantic Coast region with the exception only of a few rare or doubtful forms, namely *Culex niveitarsis* Coq. and *C. onondagensis* Felt, recently described, *Anopheles nigripes* Staeg., *A. bifurcatus* Linn. and *Culex squamiger* Coq., of doubtful or recently recorded occurrence and *Culex hirsuteron* Theob. and *C. testaceus* Wulp., of doubtful identity.

There are a number of Western species still unknown in the larva, while the West Indies and Mexico as well as the Arctic regions are largely unexplored. Still, as the table seems likely to be useful in its present form for the Eastern United States, it is herewith presented.

1. Mouth hairs in a pair of pencils folded outward and hooked at tip; larvæ predaceous..... 2.  
Mouth hairs diffusely tufted, folded inward, not hooked; larvæ not wholly predaceous, feeding on vegetable matter ..... 3.
2. Lateral comb of the eighth segment a patch of spines..... *Psorophora ciliata*.  
*Psorophora howardii*.  
A lateral plate on the eighth segment..... *Megarhinus portoricensis*.  
*Megarhinus rutilus*.
3. Air tube short, sessile, larvæ floating at surface of water ..... 4.  
Air tube longer than wide; larvæ floating below surface..... 7.
4. Teeth of comb of equal length ..... *Anopheles barberi*.  
Teeth of comb of two sizes, long and short..... 5.
5. Teeth of the lateral comb with large branches within ..... *Cellia albipes*.  
Teeth of the comb with fine, obscure pectination only..... 6.
6. Secondary teeth of the comb less than half as long as the primary ones.  
*Anopheles crucians*.  
*Anopheles maculipennis*.  
Secondary teeth of the comb over half as long as the primary ones.  
*Anopheles punctipennis*.  
*Anopheles franciscanus*.
7. Air tube linear on its outer half, armed with hooks.... *Tæniorhynchus perturbans*.  
Air tube conical, fusiform or straight, regularly tapered..... 8.
8. Abdominal hairs short stellate tufts; body pilose..... *Howardina walkeri*.  
Hairs of the first two abdominal segments long, the rest short, stellate.  
*Uranotenia sapphirina*.  
*Uranotenia socialis*.  
*Uranotenia loewii*.
- Abdominal hairs long, subequal, diminishing gradually posteriorly..... 9.
9. No ventral brush; anal processes two, dilated ..... *Wyeomyia smithii*.  
Ventral brush present. .... 10.
10. Anal processes two; tube short with row of hair tufts; antennal tuft outward.  
(*sp. Bahamas*).
- Anal processes four or none; not two..... 11.
11. Air tube short,  $3 \times 1$  or less, or if longer with but a single hair tuft; antennal tuft at the middle of the joint without set-off..... 12.  
Air tube long,  $4 \times 1$  or over, with usually many hair tufts beyond the pecten; antennæ with the terminal portion slender, the tuft usually beyond the middle..... 49.
12. Antennæ bent S-shaped, swollen without, two of the stout terminal hairs removed towards the base ..... *Culex discolor*.  
Antennæ slightly swollen, narrowed at outer two thirds beyond the tuft, white basally..... *Culex aurifer*.  
Antennæ with the tuft at the middle of the uniformly shaped joint..... 13.
13. Seventh abdominal segment with a large dorsal plate..... *Culex signifer*.  
Seventh segment without a plate ..... 14.
14. Comb of eighth segment of few spines in a single or partly double row..... 15.  
Comb of many spines in three or more rows..... 29.

15. Anal segment ringed ; ventral tufts to the base ; tube inflated..... 16.  
Without this combination of characters ; tube not inflated..... 19.  
16. Antennæ long ; anal segment long and slender ..... 17.  
Antennæ moderate ; anal segment short, wider than long..... 18.  
17. Comb of the eighth segment of six or seven subequal spines.

*Janthinosoma musicum.*

Comb of five spines, the upper and lower small..... *Janthinosoma varipes.*

18. Antennæ black on outer half ; the four spines of air tube scattered to basal half.

*Grabhamia jamaicensis.*

Antennæ all white ; the four spines of air tube restricted to basal third.

*Teniorhynchus signipennis.*

19. Anal segment not ringed ; usually with slight tufts before the barred area..... 20.  
Anal segment ringed ; no tufts before the barred area..... 24.  
20. Spines of the comb produced, elongate, blunt..... *Culex triseriatus.*  
Spines not produced, short, thorn-shaped ..... 21.  
21. Tuft of tube within the pecten ; tube with dorsal tufts..... *Culex trichurus.\**  
Tuft of tube beyond the pecten, no other tufts..... 22.  
22. Tuft of tube beyond the outer third ; anal processes pointed..... *Aedes fuscus.*  
Tuft of tube before outer third ; anal processes blunt..... 23.  
23. Anal plate longer than wide from side view, sharply incised subdorsally.

*Culex impiger.*

Anal plate wider than long ; no marginal incision..... *Culex sylvestris.*

24. Tube twice as long as wide or more ; comb of nearly simple spines..... 25.  
Tube one and a half times as long as wide ; comb of spined teeth..... 28.  
25. Comb of four to twelve teeth, large, thorn-shaped..... 26.  
Comb a small patch of spines..... 35.  
26. Anal processes long ; tube not functional ; larvæ aquatic ..... *Culex dupreei.*  
Anal processes normal ; tube functional..... 27.  
27. Tuft of tube beyond the middle but within the pecten ; anal processes with  
apical half constricted..... *Culex serratus.*  
Tuft of tube before the middle but beyond the pecten..... *Culex punctor. †*  
28. Comb of digitately spined teeth in a small patch..... 36.  
Comb of elongate teeth with central longer spine..... *Stegomyia fasciata.*  
29. Pecten of the air tube a row of hairs outwardly..... 30.  
Pecten of the air tube of toothed spines entirely..... 31. ✓  
30. Chitinized parts heavily infuscated, robust ... *Theobaldia incidens.*  
Chitinized parts usually weakly infuscated, less robust.

Scales of comb about 60 ; air tube pecten with 1 or 2 teeth.

*Culex consobrinus, Culex magnipennis.*

Scales of comb about 40 ; pecten with 2 or 3 teeth..... *Culex absobrinus.*

31. Anal segment ringed by the plate..... 32.  
Anal segment not completely ringed or with dorsal plate only..... 37.  
32. Anal processes absent ; pecten of the air tube furcate..... *Deinocerites cancer.*  
Anal processes present ; pecten of the air tube serrate..... 33.

\* Synonym, *C. cineleoborealis* Felt & Young.

† Synonym, *C. abserratus* Felt & Young.

33. Brush of tube beyond the pecten..... 34.  
 Brush of tube within the pecten..... *Culex bimaculatus*.
34. Air tube over  $2 \times 1$ , its pecten of 19-22 teeth..... 35.  
 Air tube  $2 \times 1$  or less, its pecten of 12 to 14 teeth..... 36.
35. Scales of the comb with central apical spine shorter than the body of the scale;  
 pecten of air tube of equal teeth..... *Grahamia sollicitans*.<sup>\*</sup>  
 Scales of the comb with central spine about as long as the body of the scale;  
 pecten of air tube longer outwardly..... *Culex trivittatus*.
36. Spines of comb digitately spined without central one ..... *Culex teniorhynchus*.  
 Spines of comb feathered on sides with stout central thorn..... *Culex confirmatus*.
37. Anal processes moderate, not conspicuously tracheate..... 38.  
 Anal processes large, swollen, filled with branched tracheæ..... 48.
38. Anal processes moderate, normal..... 39.  
 Anal processes short, bud-shaped..... *Grahamia curriei*. ✓
39. Pecten of the air tube with detached teeth; tracheæ broad..... 40.  
 Pecten of the air tube without detached teeth..... 41.
40. Lateral hairs of the first abdominal segments double; detached teeth of comb  
 well spaced ..... *Culex abfitchii*. †  
 Lateral hairs single; teeth only a little detached..... *Grahamia vittata*.
41. Air tube long, slender, about  $4 \times 1$ ..... 42.  
 Air tube short, stout,  $3 \times 1$  or less..... 43.
42. Tube scarcely  $4 \times 1$ ; tracheæ broad, not angled..... *Culex cantans*.  
 Tube over  $4 \times 1$ ; tracheæ narrow, angled..... *Culex fitchii*.
43. Spines of comb thorn-shaped..... 44.  
 Spines of comb thick with feathered tips..... *Culex lavarensis*.
44. Anal segment almost completely ringed, tufts to base; tube  $2 \times 1$ .  
*Culex æstivalis*.  
 Anal segment distinctly not ringed; tufts scarcely to base; tube  $3 \times 1$ ..... 45.
45. Brush moderate, tufts short-stemmed, chitin mostly brown..... 46.  
 Brush large, long stemmed, chitin mostly blackish..... *Culex pullatus*.
46. Head with black lunate spots..... *Culex cantator*.  
 Head without such spots..... 47.
47. Comb scales with apical spine longer but not stouter than the subapical ones.  
*Culex canadensis*.  
 Comb scales with apical spine stout and distinct, fringed by the smaller ones.  
*Culex pretans*.
48. Tuft of tube within the pecten; anal processes unspotted..... *Culex atropalpus*.  
 Tuft of tube beyond the pecten; anal processes spotted..... *Culex varipalpus*.
49. Antennal tuft at the middle of the joint..... *Culex restuans*.  
 Antennal tuft beyond the middle of the joint..... 50.
50. Anal segment with tufts before the barred area..... *Culex dyari*.

<sup>\*</sup> *G. sollicitans* and *C. trivittatus* are very difficult to separate. Compare Smith's figures, Ent. News, xv, pl. ix, 1904, and Bull. N. J. Agr. Exp. Sta., 171, pl. v, 1904. The former figure should be corrected by striking out the little tufts preceding the barred area on the anal segment in Fig. 6.

† Synonym, *C. siphonalis* Grossbeck.

- Anal segment without tufts before the barred area..... 51.
51. Comb of the eighth segment a row of bars..... 52.  
Comb of the eighth segment a patch of spines..... 53.
52. Bars in one single uniform row; body glabrous..... *Melanoconion melanurus*.  
Bars spine-like, in an irregular row; body pilose..... *Melanoconion atratus*.
53. Tube very long, concave, the tip a little wider..... *Culex territans*.  
Tube long, but tapered to tip..... 54.
54. Antennæ not white banded; tube somewhat fusiform..... *Culex pipiens*.  
Antennæ usually conspicuously white banded; tube tapered..... 55.
55. Tube longer, over four times as long as wide..... 56.  
Tube shorter, four times as long as wide, not over..... *Culex tarsalis*.
56. Tufts of the tube scattered, fine, irregular..... *Culex salinarius*.  
Tufts of tube along middle of posterior margin only, rather large... *Culex secutor*.

### BRIEF NOTES ON MOSQUITO LARVÆ.

BY HARRISON G. DYAR, A.M., PH.D.,

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CORRECTION OF THE ACCOUNT OF *CULEX CONSOBRINUS* DESV. — I described this larva from specimens sent by Messrs. Dupree and Morgan (Journ. N. Y. Ent. Soc., xi, 24, 1903), and expressed some doubt both there and at another time (Proc. Ent. Soc. Wash., vi, 39, note, 1904), whether the young larvæ were correctly associated. We have lately received from Dr. Dupree a full set of specimens of all stages, and it shows that the first ones were wrongly associated. There is no such remarkable change as those specimens indicated.

The eggs are laid in curved, boat-shaped masses, as in *pipiens*. The first-stage larvæ have the antennæ longer than the mouth brushes with a single hair at the middle; tube thick, about two and a half times as long as wide, with the outer half weakly infuscated, the pecten of four branched teeth with the usual tuft, composed of one hair, at about the middle of the pecten, very near the base of the tube. Anal segment with a dorsal plate and dorsal tuft of four hairs and one smaller side hair. Lateral comb of the eighth segment of five long, sharp spines. In stage ii the antennæ are as long as the mouth brushes only, with a tuft at the middle; the tuft of the air tube consists of two hairs, situated at the base of the posterior incision of the chitin, the pecten of seven branched teeth and two remote, longer, unbranched ones. The comb of the eighth segment is three rows



deep, the small spines with feathered tips. In stage iii the antennæ are the same; the tuft on the tube consists of several hairs, is situated as before, opposite the middle of the branched pecten, which is followed by several long, hair-like pectinations. Anal segment with a dorsal plate, several tufts before the barred area; comb teeth of the eighth segment with feathered tips. In the fourth stage the hair-like pecten on the air-tube is increased and elongated, while the anal segment becomes ringed by the plate. The antennæ are not changed.

IDENTITY OF *CULEX IMPIGER* WALK. — The form referred to by me under this name (Proc. Ent. Soc. Wash., vi, 37, 1904) has since been described as *pullatus*, while of the two forms referred to by Mr. Knab and myself (Proc. Ent. Soc. Wash., vi, 144, 1904), the first is *pullatus*, the second *trichurus*. This leaves the larva of *impiger* unknown; but I am glad to be able to adopt for it the one identified by Messrs. Felt and Young (Science, n. s., xx, 312, 1904), which Dr. Felt has kindly communicated to me. It closely resembles *sylvestris*, but differs therefrom in the longer anal segment, the chitinous plate of which appears longer than wide from side view and is deeply incised laterally.

LARVA OF *DEINOCERITES* CANCER THEOB. — We have received this larva from Kingston, Jamaica, through the kindness of Dr. M. Grabham. It has the general structure of *Culex*. The eyes are small but transverse, double; antennæ small, slender, uniform, with single hair tuft at the middle. Comb of the eighth segment a large patch of very small scales many rows deep, irregular in size and with divided tips. Air tube slender, four times as long as wide, a little tapered apically; two rows of pecten of few teeth, followed by a single hair on each side, the pecten teeth strongly furcate. Anal segment ringed by the plate, a dorsal patch and a small ventral one before the brush well chitinized, the sides nearly colorless. Anal processes absent, replaced by an annular cushion which is weakly divided into halves.

The larva is a very distinct one.

LARVA OF *HOWARDINA WALKERI* THEOB. — This larva also was communicated to us by Dr. Grabham, from Anchona, Jamaica, 5,000 feet altitude. It is extremely characteristic, being of the *Uranotania* form with the characters accentuated. All the hair tufts, except the lateral thoracic and those of the anal segment, are of the stellate form, composed of numerous short hairs. The head is smooth, rounded; antennæ short with hair at the middle. Abdominal segments, except in the intersegmental area, darkened by numerous small black spicules.

Comb of the eighth segment a single row of long sharp spines united by chitin at the base. Air tube about twice as long as wide, slightly tapered, the long spine-like pecten running from the base to the apex, enclosing a fine hair tuft at the outer third. Anal segment triangular, short on ventral line, about four fifths encircled by the plate which is fringed with long spines behind. Ventral brush with a small plate of chitin on each side of the barred area. Anal processes four, slender, filiform, tapering to a point, about as long as the anal segment, not tracheate.

LARVA OF GRABHAMIA CURRIEI COQ. — This was collected by Miss Isabel McCracken at Stanford, Cal. and by Mr. O. A. Johannsen at Ithaca, N. Y. It is of the ordinary short-tubed *Culex* type, yet rather characteristic by the extremely short anal processes, which are mere slight protuberances, shorter than in *sollicitans*. The head is dark brown, spotted with blackish much as in *cantator*; antennæ small with tuft at the middle; eyes large. Body hairs rather short, much as usual; abdominal tracheæ wide, band-shaped. Air tube two and a half times as long as wide, the pecten long, spine-like, evenly set, without detached teeth, branched at base, followed by a hair tuft a little beyond the middle of the tube. Comb of the eighth segment of about 25 scales in a multiple row the single scales broad and divided at tip. Anal segment with dorsal plate reaching half way down the sides, irregular on its termen. Ventral brush with a few hairs before the barred area.

NOTE ON CULEX CANTATOR COQ. — The larvæ occurred at Weekapaug, R. I., mixed with *sollicitans* in the temporary salt pools on the marshes and also in fresh water grassy marshes a little further from the sea. Professor Smith's figure of the larva (Bull. 171, N. J. Agr. Exp. Sta., pl. vii, 1904) brings out the main structural points, but is faulty in the representation of the anal segment, which is only about three fourths ringed by the plate, not completely so as there shown.

HIBERNATION OF MELANOCONION MELANURUS COQ. — We were under the impression that this matter had gone on record, but such is evidently not the case, since Dr. Felt says recently (N. Y. State Mus., Bull. 79, 337, 1904) "the adult hibernating." This species is very peculiar in hibernating as the mature larva; we know of no parallel case. Mr. Brakeley has demonstrated the fact beautifully. The large larvæ in the pools in the late fall cannot be made to pupate but persist in hibernating. In the spring, however, after the ice is well melted they will pupate, though the larva is always deliberate about its trans-

formations. We believe that this species always hibernates as full grown larva and not in any other manner.

IDENTITY OF *CULEX ABFITCHII* FELT. — This is the form described as "*cantans* 1" by Mr. Knab and myself (Proc. Ent. Soc. Wash., vi, 143, 1904). What Dr. Felt calls *cantans* is a third form, figured as *cantans* by Dr. J. B. Smith and which we had not previously distinguished. It will be found defined in the preceding table. The comparison of European material is now more urgently needed than before.

LARVA OF *MELANOCONION ATRATUS* THEOB. — Mr. Theobald has published a photograph of this larva (Mon. Culic., III, pl. xvi, 1903), but the enlargement is insufficient to bring out any of the distinctive characters. I have received the species from New Orleans, from Dr. Dupree (through Dr. Howard). It belongs in the *territans* group and falls near *melanurus*, but the spines of the comb are in a less regular row than in that species, while the whole body is minutely pilose.

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## Class I, HEXAPODA.

### Order IX, HEMIPTERA.

## A LIST OF CERTAIN FAMILIES OF HEMIPTERA OCCURRING WITHIN SEVENTY MILES OF NEW YORK.

By J. R. DE LA TORRE BUENO,

NEW YORK, N. Y.

(Continued from Vol. XII, page 253.)

### Family PENTATOMIDÆ.

In this family I follow the classification and nomenclature employed in the most recent American authoritative discussion of the group, "Annotated List of the Pentatomidæ Recorded from America North of Mexico," by Mr. E. P. Van Duzee. (Trans. Am. Ent. Soc., No. 1, Vol. xxx, 1904.)

#### Subfamily CORIMELÆNINÆ.

#### Genus CORIMELÆNA White.

**C. unicolor** de Beauvois (= *helopioides* Wolff = *atra* Amyot & Serville).

Jamesburg, N. J., August 5; Newfoundland, N. J., May and July; Staten Id., N. Y., June 12 and 23; West Hebron, N. Y., August; Van Cortlandt Pk., N. Y. September 19; Westfield, N. J., July 7.

This is apparently the most abundant species in this vicinity.

**C. nitiduloides** Wolff (= *histeroides* Say).

Newfoundland, N. J.

Only one specimen, taken by Mr. Davis. This would seem to be a rare form hereabout.

**C. pulicaria** Germar.

Mosholu, N. Y., July 8; Jamesburg, N. J., July 5; Lakehurst, N. J., July 12, Staten Id., N. Y., July 20; Westfield, N. J., July 16, 30, August 7.

This is a very common and widespread species, and appears on all lists. Mr. Davis' specimens were originally determined as *Corymelana lateralis*, and so appear in the New Jersey list; but this is a western form. The record for these specimens, therefore, is incorrect.

Subfamily SCUTELLERINÆ.

This subfamily is not represented in Prof. Smith's list.

Genus **TETYRA** Fabricius.

**T. bipunctata** Herrich-Schaeffer.

Lakehurst, N. J., April 25 (Davis) May 5 and 28.

This interesting form is found but not frequently at Lakehurst, and is ordinarily taken by beating the pines. It is of interest, as it is a southern insect, and Lakehurst, in the Pine Barrens, is in all probability its extreme northern range.

Genus **AULACOSTETHUS** Uhler.

**A. marmoratus** Say.

Lakehurst, N. J., April 30 and September 19 (Davis).

This is of infrequent occurrence.

Genus **HOMÆMUS** Dallas.

**H. æneifrons** Say.

Hamilton Co., N. Y. (Davis); Westfield, N. J., July 2.

This also is apparently quite rare.

Genus **EURYGASTER** Laporte.

**E. alternatus** Say.

Hewitt, N. J., August; West Hebron, N. J., June and September (Davis).

This seems to be more common and widespread than either of the preceding.

Subfamily GRAPHOSOMINÆ.

Genus **PODOPS** Laporte.

**P. dubius** de Beauvois.

New Jersey, March (Davis).

This specimen has in some degree the longer lateral pronotal processes mentioned by Van Duzee. It is the specimen the record of which Prof. Smith credits to Mr. Davis, and was determined by Dr. Ashmead.

**P. cinctipes Say.**

New Jersey, March 23, 1903.

These specimens were taken under stones by Mr. A. C. Weeks. This is the common form in this locality, if indeed, the other one be actually found here.

Subfamily CYDNINÆ.

Genus CYRTOMENUS Amyot & Serville.

**C. mirabilis Perty.**

Staten Id., August.

This is the specimen recorded in Prof. Smith's list, and was determined by Dr. Ashmead. According to Van Duzee, this bug is strictly southern.

Genus CYDNUS Fabricius (= *Microporus* Uhler).

**C. (Microporus) obliquus Uhler.**

Aqueduct, N. Y., September 19 (Davis).

According to Mr. Van Duzee, this insect is southwestern, but nevertheless, the specimen mentioned was taken by Mr. Davis in the Long Island locality named.

Genus PANGÆUS Stål.

**P. bilineatus Say.**

"N. J." (Davis), March 23.

As Mr. Davis' collecting is limited practically to the area selected, it is fair to assume that he found it within the prescribed limits. The specimen mentioned is the only one I have seen, and was determined by Dr. Ashmead.

Genus AMNESTUS Dallas.

**A. spinifrons Say.**

Staten Id., N. Y., May and June (Davis).

Recorded in Smith's list, and determined by Dr. Ashmead.

Genus SEHIRUS Amyot & Serville. (= *Canthophorus* Mulsant & Rey).

**S. cinctus de Beauvois.**

Hamilton Co., N. Y. (Davis).

Subfamily PENTATOMINÆ.

Some of the records, localities and dates in this subfamily are additional to my list of the Pentatomidæ, in Journ. N. Y. Ent. Soc., for December, 1903.

Genus BROCHYMENA Amyot & Serville.

**B. arborea Say.**

Staten Id., N. Y., August 31, June 11, September; Lakehurst, N. J., May 26, June, September 6.

Not uncommon at Lakehurst, from which locality I have seen a number of specimens, and has been taken occasionally in Staten Id. by Mr. Davis.

**B. quadripustulata Fabricius.**

Lakehurst, N. J., May 24 and September 4; Staten Id., N. Y., June 30, July 13, and September 10; W. Hebron, N. Y., June.

This has been taken by Mr. Davis on pine, according to the label on one of his specimens, and together with the preceding appears to be the most common form in this vicinity.

**B. annulata Fabricius.**

Lakehurst, N. J., June 26.

Found rather rarely at Lakehurst, where it is taken by beating the pines.

**Genus PERIBALUS Mulsant & Rey.**

**P. limbolarius Stal.**

Lakehurst, N. J., July 16 and September 6; Ramapo, N. Y., May 31; Staten Id., N. Y., May 11 and June 14; Van Cortlandt Park, N. Y., September 12, 1903.

**Genus TRICHOPEPLA Stal.**

**T. semivittata Say.**

Ft. Montgomery, N. Y., July 26; Little Falls, N. J., May; Staten Id., N. Y., June 8, August 16, September 26, October 3; Van Cortlandt Pk., N. Y., September 12; Mosholu, N. Y., October 3; Westfield, N. J., August 13, September 3.

This insect is abundant wherever found.

**Genus PENTATOMA Olivier.**

This genus is mentioned in Smith's List as *Lioderma* Uhler.

**P. (*Lioderma*) saucia Say.**

Staten Id., N. Y., April and September.

These captures are by Mr. Davis, who has found it now and then.

**P. (*Rhytidolomia*) senilis Say.**

Staten Id., N. Y., April, July, September and October.

This is locally the most abundant of the genus.

**P. (*Chlorochroa*) uhleri Stal.**

W. Hebron, N. Y., August.

This is one of Mr. Davis' interesting specimens and was taken by Mr. C. W. Leng. Mr. Van Duzee gives it (l. c.) as occurring in Colorado and the Rocky Mts. Possibly this is its extreme Eastern range.

**Genus MORMIDEA Amyot & Serville.**

**M. lugens Fabricius.**

Jamesburg, N. J., July 13; Perth Amboy, N. J., May 31; Ramapo, N. Y., May 31; Staten Id., N. Y., June and August; Westfield, N. J., July 2.

Very common and abundant in this vicinity, from early spring to late fall.

**Genus ŒBALUS Stal.****O. pugnax Fabricius.**

Anglesea, N. J., July 4 (Dr. E. G. Love).

**Genus EUSCHISTUS Dallas.**

This is by far the best represented and most abundant genus in the district under discussion.

**E. fissilis Uhler.**

Hewitt, N. J., July; Jamesburg, N. J., July 5 and August 31; Ramapo, N. Y., May 31; Staten Id., N. Y., May 31, June 11, September; W. Hebron, N. Y., August and September; Westfield, N. J., July 30, August 7 and September 3.

**E. servus Say.**

Jamesburg, N. J., July 5; Staten Id., June and September.

Rare. The identification is by Dr. Ashmead.

**E. politus Uhler.**

Jamesburg, August 31; Lakehurst, N. J., October 6.

A rather rare insect, apparently, taken by Mr. Davis in the localities mentioned.

This appears in Dr. Smith's N. J. List as *Podisus politus*.

**E. tristigmus Say.**

Forest Pk., L. I., June 27; Ft. Montgomery, N. Y., July 26; Ramapo, N. Y., May 31; Staten Id., N. Y., June 12, October; W. Hebron, N. Y., August and September; Newfoundland, N. J., July and September; Mosholu, N. Y., June 6 and October 1; Westfield, N. J., July 4 and August 7.

This form is common in the grasses in moist or marshy meadows.

**E. variolarius de Beauvois.**

Jamesburg, N. J., June 22 and July 5; Lakehurst, N. J., June, July 12; Long Island, N. Y., July 29; Mosholu, N. Y., October 3; Newfoundland, N. J., May, Putnam Co., N. Y., September 5; Ramapo, N. Y., May 31, Staten Id., N. Y., June 12 and 26, July 20, August 2, October 10 and 23; W. Hebron, N. Y., August and September; Westfield, N. J., July 4 and August 7.

This species, together with *fissilis*, with which it may be confounded, and with *tristigmus*, are locally the most common and abundant species.

**Genus CENUS Dallas.****C. delius Say.**

Staten Id., N. Y., June 14 and September 2; Singac, N. J., September 1; W. Hebron, N. Y., August and September; Mosholu, N. Y., October 1; Westfield, N. J., July 16 and 30.

Common in the area under discussion.

**Genus HYMENARCYS Amyot & Serville.****H. nervosa Say.**

Staten Id., June 30 and August 2.

**GENUS MINEUS Stal.****M. strigipes Herrich-Schaeffer.**

Westfield, N. J., July 4.

**Genus COSMOPEPLA Stal.****C. carnifex Fabricius.**

Newfoundland, N. J., July 4 ; W. Hebron, N. Y., June, August and September.  
This is a very common species.

**Genus MENECLIS Stal.****M. insertus Say.**

Sparta, N. J.

This is the specimen recorded by Professor Smith.

**Genus THYANTA Stal.****T. custator Fabricius.**

Brookville, N. J., July ; Lakehurst, N. J., May 1, June 26, July 12, September 14, October 9.

This form is quite common in the pine barrens of New Jersey.

**Genus NEZARA Amyot & Serville.****N. pennsylvanica DeGeer.**

Jamesburg, N. J., June 22 and July 5 ; Staten Id., N. Y., February 11.

**N. hilaris Say.**

Deal, N. J., May ; Jamesburg, N. J., August 31 ; Ft. Montgomery, N. Y. July 26 ; Staten Id., N. Y., June, July, August 31 and October.

The latter is the more common of the two species locally.

**Genus BANASA Stal.****B. calva Say.**

Lakehurst, N. J., September 26.

**B. dimidiata Say.**

Lakehurst, N. J., October 20.

**Genus LIOTROPIS Uhler.****L. humeralis Uhler.**

Lakehurst, N. J., September 6 ; Ft. Montgomery, N. Y., July 26.

This is apparently a rather common insect in this vicinity, as it was taken in fair numbers by Mr. Davis on the dates cited.

**Subfamily ASOPINÆ.****Genus STIRETRUS Laporte.****S. anchorago Fabricius.**

Jamesburg, N. J., July 4, 1890.

This is the only specimen I have ever seen from this locality, and is the one taken by Mr. Davis, which figures in Dr. Smith's N. J. list.



**Genus PODISUS Herrich-Schaeffer.**

**P. cynicus Say.**

Brookville, N. J., July; Hewitt, N. J., July; Staten Id., N. Y., August.

I have never taken this, and from Mr. Davis' few specimens, would conclude it is not abundant locally. In general, also, these individuals are smaller than examples from the South in my collection.

**P. maculiventris Say.**

Jamesburg, N. J., July 5 and August 31; Ft. Montgomery, N. Y., July 26; Ramapo, N. Y., May 31; Staten Id., N. Y., March, June 12 and 27, August 2 October 26; W. Hebron, N. Y., August and September.

This is the most common member of the genus in this vicinity.

**P. modestus Dallas.**

Ft. Montgomery, N. Y., May 31.

This neat little species is apparently quite rare within my limits, the specimen noted being taken by Mr. Davis.

**Subfamily ACANTHOSOMINÆ.**

**Genus ACANTHOSOMA Curtis.**

**A. lateralis Say.**

Staten Id., N. Y., April 19.

Rarely found. This specimen was taken by Mr. Davis.

**Family COREIDÆ.**

This important family is well represented in some of its species, which are very abundant in this district.

**Genus CHARIESTERUS Laporte.**

**C. antennator Fabricius.**

Jamesburg, N. J., July 5; Lakehurst, N. J., July 29.

Apparently uncommon. I have taken none, and Mr. Davis but two, in some years' collecting.

**Genus CORYNOCORIS Mayr.**

**C. typhæus Fabricius.**

Ft. Montgomery, N. J., July 27; Mosholu, N. Y., July 26; Staten Id., N. Y. June; Westfield, N. J., July 4 and September 3.

**Genus ARCHIMERUS Burmeister.**

**A. calcarator Fabricius.**

Forest Pk., L. I., N. Y., June 27; Ft. Lee, N. J., August 8; Ft. Montgomery, N. Y., July 27; Mosholu, N. Y., May 29, June 13 and 22, July 25 and 26 October 4.

This is a very common form, and can be found in the adult practically through the year.

**Genus EUTHOCTA Mayr.****E. galeator Fabricius.**

Mosholu, N. Y., September 6; Newfoundland, N. J., July; Staten Id., N. Y., June and September.

This is of rather infrequent occurrence.

**Genus METAPODIUS Westwood.****M. terminalis Dallas.**

Mosholu, N. Y., September 6; Ramapo, N. Y., May 31; Staten Id., N. Y., May 7 and 8, June 20, September 8.

This also is rather uncommon. In two years' collecting I have secured but one immature adult.

**Genus LEPTOGLOSSUS Guérin.****L. oppositus Say.**

Staten Id., N. Y., October.

This is the specimen credited to Mr. Davis in the N. J. List, and as it is the only one I have seen from this vicinity, it would seem to be quite rare.

**Genus ANASA Amyot & Serville.****A. tristis DeGeer**

Jamesburg, N. J., June 22.

I have taken none of this species, and Mr. Davis only the one as above, possibly because neither of us frequents squash vines.

**Genus ALYDUS Fabricius.**

This is the most abundant genus of the family; both as to species and individuals. They are ordinarily to be found on bush-clover in the flowering season actively flying about. They make a rather loud noise with the wings, and in their flight resemble somewhat Hymenopterous insects. *Alydus calcarator* Fabr. (= *calcaratus* Uhl., not Linné), mentioned in the N. J. List, has been shown by Prof. A. L. Montandon ("Notes on American Hem. Het.," Proc. U. S. N. M., Vol. XVI, pp. 45-52, 1893) to be strictly European, and not to occur on this continent. The form identified with this he described as new under the name *Alydus conspersus* Mont.

**A. eurinus Say.**

Forest Pk., L. I., N. Y., June 27; Hewitt, N. J., July; Jamesburg, N. J., July 5 and August 31; Mosholu, N. Y., May 29, June 20, 22 and 28, July 25, August 8, October 18; Newfoundland, N. J., September; Staten Id., N. Y., June 12, August 2, September 6, 8 and 20; Van Cortlandt Pk., N. Y. City, August 15 and September 12; Westfield, N. J., August 7 and 13.

This is very common and abundant.

**A. pilosulus Herrich-Schaeffer.**

Forest Pk., L. I., N. Y., June 27; Brookville, N. J., July; Jamesburg, N. J., June; Mosholu, N. Y., June 22 and 28, July 19; Newfoundland, N. J., September; Van Cortlandt Pk., N. Y. City, June 6, August 15, September 12; Westfield, N. J., July 9 and September 5.

This form also is common, and occurs with the preceding in similar situations.

**A. quinquespinosus Say.**

Ft. Montgomery, N. Y., July 27; Hewitt, N. J., July; Jamesburg, N. J., August 31; Mosholu, N. Y., June 13 and 20, July 12 and 25, August 8 and 23; Palisades, N. J., August 22; Staten Id., N. Y., September 8 and 10, August 31.

This species is taken with the two preceding, but is not as abundant.

**A. conspersus Montandon.**

Newfoundland, N. J., September, 1899.

I have seen only this one specimen, determined by me, in the collection of Mr. Davis, and have taken none myself.

**Genus HARMOSTES Burmeister.**

**H. reflexulus Stal.**

Cold Spring Harbor, N. Y., July 28; Ft. Montgomery, N. Y., July 26; Ramapo, N. Y., May 31; Lakehurst, N. J., September 5; Mosholu, N. Y., August 4, 7, 9 and 15, September 13; Westfield, N. J., July 9 and August 13.

This is quite common.

**Genus CORIZUS Fallen.**

**C. lateralis Say.**

Jamesburg, N. J., July 5; Lakehurst, N. J., May 26 and July 12; Newfoundland, N. J., May; Mosholu, N. Y., July 26 and August 8; Van Cortlandt Pk., N. Y. City, September 1 and 13.

This is another common form.

**Family BERYTIDÆ.**

**Genus NEIDES Latreille.**

**N. muticus Say.**

Ft. Montgomery, N. Y., July 26.

**Genus JALYSUS Stal.**

**J. spinosus Say.**

New York City, October 21; Westfield, N. J., July 2.

The first specimen is of interest, because it was captured in the window of one of the tall Broadway buildings, about 120 feet above the street.

**Family PYRRHOCORIDÆ.**

**Genus LARGUS Hahn.**

**L. succinctus Linnæus.**

Lakehurst, N. Y., May 25 and September 19. (Davis.)

This Hemipteron is very common in Lakehurst from May to September or later.

**Family ARADIDÆ.**

In this family I have not yet succeeded in collecting many specimens personally, and for the local material in my collection, I am indebted to the kindness of Mr.

Davis, who has generously filled gaps in my series, and therefore, most records belong to him. All the insects in this family from which the records credited by Prof. Smith to Mr. Davis have been made, have passed under my eyes, and I make the comments necessary in their proper place.

**Genus ARADUS Fabricius.**

**A. æqualis Say.**

W. Hebron, N. Y., June.

**A. robustus Uhler.**

Ft. Montgomery, N. Y., May 31.

**A. similis Say.**

Staten Id., N. Y., April 4.

**A. acutus Say.**

Lakehurst, N. J., April 15.

The two last named species, Prof. Smith has put in his list on the authority of Prof. Uhler's Check List, and as far as known to me, these are the first actual records of captures from the region treated of by Dr. Smith.

**A. cinnamomeus Panzer.**

Lakehurst, N. J., May 1 and 27; Staten Id., N. Y., April 10. (This is the specimen named in Smith's List.)

This form is very abundant in Lakehurst, on the pines, where Mr. Davis and I have taken it by beating, at different times. It occurs in three forms, wingless, with partly developed wings, and I have met with one fully winged individual.

**A. niger Stal.**

Lakehurst, April 14.

This is another of Mr. Davis' fortunate captures, as it is a rather rare insect. This is an addition to the New Jersey list.

**A. lugubris Fallen.**

Staten Id.

This is the specimen recorded by Dr. Smith in his list. In his enumeration he gives this species twice, the other record being under the synonym *A. rectus* Say.

**A. sp.**

Staten Id., April 10.

This is the species given in the N. J. list as *A. robustus* Uhl., which it certainly is not, as it does not agree with Uhler's original description.

**Genus NEUROCTENUS Stal.**

**N. simplex Uhler.**

Jamesburg, N. J., June 22; Lakehurst, N. J., July 12 and 19; Westfield, N. J., June 19 and September 4.

This species is recorded twice by Dr. Smith, the other time under the genus *Brachyrhynchus*, under which Uhler originally described it.

## Genus ANEURUS Curtis.

**A. politus Say.**

Staten Id., June 26.

**A. septentrionalis Walker.**

Perth Amboy, N. J., May 31; Staten Id., May 12; Westfield, N. J., August 14 and September 4.

This species and the preceding are new records from the area under discussion. The latter species appeared in the New Jersey list as *Brachyrhynchus simplex* Uhl.

## Family PHYMATIDÆ.

## Genus PHYMATA Latreille.

**P. erosa Linnæus** (= *P. wolffii* Stal.).

Lakehurst, N. J., July 29 and August 12; Singac, N. J., September; Staten Id., N. Y., April 9, August 2, 8 and 31, September 26, October 3 and 5; W. Hebron, N. Y., August; Westfield, N. J., July 30 and August 21.

**P. sp.**

Ramapo, N. Y., May 16.

One specimen only. This is a small species, about 6 mm. long, and entirely unlike the preceding in the shape of pronotum and dilated abdomen. In the absence of Dr. Handlirsch's monograph, I do not care to pronounce positively on its specific position.

## Family HYDROMETRIDÆ.

Genus HYDROMETRA Latreille (= *Limnobates* Burmeister).**H. martini Kirkaldy** (= *H. lineata* Say).

Staten Id., May 7 and 16, April 11 (Davis), September 26; Van Cortlandt Pk., N. Y. City, April 11 and July 4; Westfield, N. J., June 19, July 3 and 9, September 11; Rahway R., Cranford, N. J., August 27.

American entomologists, following Burmeister and Stal, have always called this genus *Limnobates* and the family *Limnobatide*. Dr. Burmeister's facility for changing names has given rise to great confusion in this respect, since the more recent European specialists (Montandon, Horvath, Kirkaldy, Puton, et al.) have correctly appreciated the synonymy, and have shown that Latreille founded the genus on *Hydrometra stagnorum* Linné, and that the family is therefore Hydrometridæ, and the genus *Hydrometra*. I do not follow them in putting in the Gerridæ and Veliidæ with it, for reasons not necessary to go into in detail, and consider these as separate families. The specific name, as Kirkaldy points out\* cannot stand, as it is preoccupied by *H. lineata* Eschsch., from Manila, so he has changed it to *martini*.

*H. martini* is of retiring habits. In Staten Id., at the same pond, or rather, marsh, Mr. Davis and I have found it in numbers. We have taken together at least 150 specimens and let as many more escape. The females seem to be the more abundant in numbers. In all these, we have met with but two winged individuals,

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\* The Entomologist, June, 1900, p. 176.

both male; all the others being completely apterous. One specimen was taken by Mr. Davis in a plowed field, some distance from water. This Hemipteron overwinters in the adult form and begins oviposition early in May. How late it may continue, I am unable to say, as I have two females in an aquarium at this writing (July 15), and they are still ovipositing. The females recently arrived at the adult stage, which they do some time in early July from the spring ova, also oviposit at this time of year, so that it is quite possible that they are double brooded, the more so that the entire period of development from the ovum to the adult appears to take but little over six weeks, the moults being very rapid. I feed them flies—a staple breakfast food, with insects I rear—to which they take kindly, fastening their long rostra into the insect even before it ceases to struggle. It seems immaterial, however, that their prey should be fresh, as they appear to feed on dead insects as much as two or three days old. They *run* on the surface of the water with considerable swiftness, exactly as if they were on a solid surface.

### Family GERRIDÆ.

In this family, nearly all of Stål's different genera become subgenera, according to Kirkaldy, who writes me that they are connected by intermediate forms, and in deference to his exhaustive knowledge of the subject, I so consider them in the following, regarding them as subgenera of the genus *Gerris*.

#### Genus GERRIS Latreille.

##### **G. (*Hygrotrechus* Stal) *remigis* Say.**

Lakehurst, N. J., May 30; Central Park, N. Y. City, April 11; Mosholu, N. Y., May 4 and October 1; Putnam Co., N. Y., September 5; Staten Id., N. Y., March 29; Van Cortlandt Pk., N. Y. City, July 4; Rahway R., Cranford, N. J., August 6 and 20; Westfield, N. J., July 4 and 16, August 11.

This is very abundant in running and sometimes on still waters, from early spring, as soon as the ice melts, till late fall. Winged individuals are rather rare.

##### **G. (*Hygrotrechus*) *conformis* Uhler.**

Putnam Co., N. Y., September 5; Rahway R., Cranford, N. J., August 6.

I have taken only the two specimens recorded, both winged individuals.

##### **G. (*Limnotrechus* Stal) *marginatus* Say.**

Bronx, N. Y. City, September 30; Central Park, N. Y. City, March 22; Ft. Lee Dist., N. J., July 4 and 18, October 10; Lakehurst, N. J., May 23, 25 and 30; Staten Id., N. Y., March 29, May 7, August 16; Putnam Co., N. Y., September 5; Van Cortlandt Pk., N. Y. City, April 18 and 15, June 6, September 19; October 1; Rahway R., Cranford, N. J., August 8.

This is very common on still waters. I have found it especially abundant at Van Cortlandt in the early spring, on the lake, where it keeps close to the shore. It occurs in three forms, but I have rarely taken the wingless, the fully winged being the most common.

##### **G. (*Limnotrechus*) *sulcatus* Uhler.**

Van Cortlandt Pk., N. Y., October 1.

One specimen only taken.

**G. (*Limnotrechus*) *canaliculatus* Say.**

Central Park, N. Y. City, March 22; Palisades, N. J., April 19; Putnam Co., N. Y., September 5; Staten Id., N. Y., May 7; Van Cortlandt Pk., N. Y. City, March 28, April 25 and October 1; Westfield, N. J., June 20, August 13, September 9; Rahway R., Cranford, N. J., August 6 and 20.

This differs from the preceding in its greater slenderness and longer and more slender antennæ and legs. It is quite rare and is found in the three forms. However, at Echo Lake I took quite a number in a little dark cove full of drift and twigs, among which they were hiding. The two last-named species are additional to the N. J. List.

**G. (*Limnporus* Stal.) *rufoscutellatus* Latreille.**

Ft. Lee Dist., N. Y., April 19, May 9, July 18, August 9, September 7, October 10; Putnam Co., N. Y., September 5; Van Cortlandt Pk., N. Y. City, June 6; Westfield, N. J., July 4.

This abounds on the surface of the rock pools in the Palisades, where I have found it only in the macropterous form.

**Genus *TREPOBATES* Uhler (= *Stephania* B. White).**

***T. pictus* Herrich-Schaeffer.**

Lakehurst, N. J., October 18 (Davis); Lake Mahopac, N. Y., September 5; Echo Lake, Westfield, N. J., September 2.

The specimen from Lake Mahopac was taken among a great number of *Metrobates hesperius* Uhl. At Echo Lake, however, it occurred in swarms, in several stages, near the water's edge, in company with *Rheumatobates rileyi*. Not heretofore recorded from New Jersey.

**Genus *RHEUMATOBATES* Bergroth.**

This odd and interesting genus, in which the males are distinguished by their peculiarly formed prehensile antennæ, was discovered a number of years ago by Dr. J. L. Zabriskie, in Long Island. It has not since, I believe, been recorded from this vicinity.

***R. rileyi* Bergroth.**

Echo Lake, Westfield, N. J., September 2; Rahway R., Cranford, N. J., August 6, 20 and 27.

This little bug is extraordinarily abundant in both localities, more especially on the still waters of Echo Lake. On the river, it hugs the shores, and seeks the quiet waters of little coves. It was taken in several stages at both localities. Only one winged specimen was found, a male *in cop.*, out of hundreds taken.

**Genus *METROBATES* Uhler.**

***M. hesperius* Uhler.**

Lake Mahopac, N. Y., September 5.

This insect is exceedingly abundant on the lake, where myriads congregate, forming large black patches on the water near the shores.

## Family VELIIDÆ.

## Genus MICROVELIA Westwood.

**M. americana** Uhler (= *Hebrus americanus* Uhler).

Central Park, N. Y. City, March 22; Ft. Lee Dist., N. J., May 28 and September 7; Bronx, N. Y. City, September 30; Staten Id., N. Y., March 29; Rahway R., Cranford, N. J., August 6 and 20; Westfield, N. J., July 4, 16, 30, August 13, September 2.

I have placed this insect here, as it is evidently a *Microvelia* and not a true *Hebrus*. The generic characters do not agree with those given for the latter genus by Amyot & Serville. The Hemipteron is extraordinarily abundant under the banks of a little stream near Leonia, and this spring I found it on another little stream at Fort Lee. It appears to prefer running water. Out of a long series I obtained only one fully winged individual. In the N. J. List, Prof. Smith gives it from "Atlantic States" fide Uhler. In another little stream in Westfield, in a little bayed-in place and under the overhanging banks, took several more winged individuals. They were abundant in all the places cited, and rest usually on the shore or on floating logs at the water's edge, onto which they run on being alarmed, returning immediately to the shore.

**M. pulchella** Westwood.

Staten Id., May 5 and August 16. Ft. Lee, N. Y., July 18.

I have taken but few specimens of this form, two of those taken this spring on Staten Id. being winged individuals. This species is lacustrine, and to be found running on *Lemna*.

I have also taken what are apparently three other species of the genus, one near *M. americana* Uhl., and the other two near *M. pulchella* Westw., but have not been able to determine them, due to absence of literature.

## Genus MESOVELIA Mulsant.

**M. mulsanti** White (= *M. bisignata* Uhler).\*

Ft. Lee Dist., N. J., August 20 and 22, September 7 and 18; Putnam Co., N. Y., September 5; Staten Id., N. Y., August 16 and September 26; Van Cortlandt Pk., N. Y. City, August 15, September 19 and October 1; Westfield, N. J., June 26, July 3 and 9, September 2; Rahway R., Cranford, N. J., August 6 and 27.

This is very abundant on *Lemna*, in still waters. I have taken it in the three forms, fully winged, brachipterous, and apterous, the last being the most abundant. This is a most widespread bug. It is recorded from the greater part of the continent, the Antilles, and as far down as the Amazon River. In the Rahway River at Cranford and in general in that district, the winged form is much more abundant than I have seen it elsewhere.

## Genus RHAGOVELIA Mayr.

**R. obesa** Uhler.

Lakehurst, N. J., July 11, September 5 and October 18; Rahway R., Cranford, N. J., August 6, 20 and 27.

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\* Champion, Biol. C. A., Rhynchota, Hem. Het., II, p. 123.



It is abundant in Lakehurst, where Mr. Davis took it. Very abundant in riffles and rapid portions of the current on the Rahway R., where it can be seen swimming against the stream in zigzags. Winged individuals were far from uncommon and generally congregated in the slackwater behind rocks projecting above the surface. I took them principally in these situations.

### Family GELASTODORIDÆ.

(= *Galgulidæ olim.*)

A few words in explanation of this change are not amiss. The old familiar "*Galgulus*" Latr. has for many years been preoccupied in *Aves*, and since under the rule of priority it cannot be used, Kirkaldy has proposed the name *Gelastocoris* for the typical genus, thus changing the family name as well. This change has been adopted by authorities, notably by Champion in *Biologia Centrali-Americana*.

#### Genus PELOGONUS Latreille.

##### *P. americanus* Uhler.

Staten Id. (Davis), Mosholu, N. Y., May 29; Westfield, N. J., July 4 and 7.

I have seen few specimens of this interesting little species, which links the Saldidæ on the one hand with the Galgulidæ on the other. The specimen from Staten Island is the one recorded in Dr. Smith's List.

#### Genus GELASTOCORIS Kirkaldy (= *Galgulus* Latr., preocc.)\*

##### *G. oculus* Fabricius.

Staten Id. (Davis). I have not seen this insect in this vicinity, and the only specimen I am acquainted with from our region is the one in Mr. Davis' collection, which is also the one recorded by Prof. Smith.

### Family NAUCORIDÆ.

#### Genus PELOCORIS Stal.

##### *P. femoratus* de Beauvois.

Delair, N. J.; Staten Id., N. Y., May 7 and 16, September 26, October 25; Van Cortlandt Pk., N. Y. City, March 11 and 18, May 2, June 6, July 27; Rahway R., Cranford, N. J., August 27.

This is a widespread species, ranging from Massachusetts down through Mexico and into South America. It is abundant wherever present.

### Family BELOSTOMIDÆ.

In the "Bulletin de la Société des Sciences," of Bucarest, Rumania, year IX, nos. 2 and 3, Prof. Montandon clears up the generic synonymy of this family, and shows that the type of *Belostoma* Latr. is a *Zaitia* auctt., and therefore drops the latter generic name for the prior one, whence *Zaitia* is now known as *Belostoma*; the old *Belostoma* not standing, he has proposed the name of Stal's subgenus *Amorgius* in its place. I have here accepted his conclusions and employ his nomenclature.

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\* Kirkaldy, The Entomologist, 1897, p. 258.

Genus **BELOSTOMA** Latreille (= *Zaitha* auct.).**B. flumineum** Say.

Bronx, N. Y. City, September 9; Forest Pk., L. I., N. Y., November 7; Palisades, N. J., August 20 and 22, September 7; Staten Id., N. Y., August 16, September 8 and 26, October 24 and 25; Van Cortlandt Pk., N. Y. City, March 25; Rahway R., Cranford, N. J., August 6 and 20.

This is by far the most abundant member of the family, or at least, the most easily taken. It can be found in almost any muddy pond with abundant vegetation.

**B. testaceum** Leidy.

Delair, N. J. This is additional to the N. J. List, and was sent to me by Mr. W. P. Seal among a lot of aquatics he very kindly favored me with.

**B. sp.**

Delair, N. J. Van Cortlandt Pk., N. Y. City, March 28. This form I have found now and then, and have taken about three or four specimens all told. It is smaller and rounder than either of the two preceding, and I cannot satisfactorily identify it.

Genus **AMORGIUS** Stal (= *Belostoma* auct.).**A. americanum** Leidy.

Ft. Lee, N. J., April and September 18.

**A. obscurum** Dufour.

Ft. Lee, N. J., April and September 18. Mt. Vernon, N. Y., June 4.

This name has been reduced to synonymy, and so appears in Prof. Uhler's "Check List." Prof. Montandon, however, rehabilitates it and shows that it represents undeniably a good species.\* This and the preceding I have taken in the last nymphal stage and allowed to come to maturity in my aquaria. This is the only way I have been able to get them, and except at electric lights, I doubt that it is easy to capture swift swimmers. The nymphs of both species differ from the adults, in addition to the lack of wings and general undeveloped condition, in having the anterior tarsi biungulate.

Genus **BENACUS** Stal.**B. griseus** Say.

New York City, July 22.

This is the only specimen I have taken of this insect. I found it flapping its wings under an electric light. Mr. Davis, however, has a good series from Staten Id. It appears to be much more abundant than *Amorgius*.

Family **NEPIDÆ**.Genus **NEPA** Fabricius.**N. apiculata** Uhler.

Staten Id., N. Y. (Davis). Mt. Vernon, N. Y.; Westfield, N. J., July 16 and August 13.

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\* "Hem. Het. Exotiques, Notes et Descr., II, Fam. Belostomidæ," Ann. Soc. Ent. Belg. t., XL, pp. 508-520, 1896.

Although I have diligently sought this insect, I have not yet succeeded in taking the adult. I have seen only two specimens, the ones recorded above. This would appear to be very rare hereabout.

**Genus RANATRA Fabricius.**

**R. fusca de Beauvois.**

Central Park, New York City. This is commonly given in the text-books as the common species in the East. I have, however, taken only the one specimen recorded, and have seen no others from this vicinity.

**R. quadridentata Stal.**

Central Park, New York City, March 12; Forest Pk., L. I., November 7; Ft. Lee, N. J., August 20 and 22, September 7 and 18; Putnam Co., N. Y., September 5; Van Cortlandt Pk., N. Y. City, March 25; Rahway R., Cranford, N. J., August 27.

This form is by far the most abundant locally, as it seems to be throughout the United States, to judge from material received from many quarters.

**R. kirkaldyi Bueno. (Ms.).**

Putnam Co., N. Y., September 5.

This is a very small species, with shorter air-tubes in proportion to the body than either of the preceding. It will be described by me in a paper in preparation. I have taken only one specimen of this, but have a large series sent in by a collector.

**Family NOTONECTIDÆ.**

**Genus NOTONECTA Linnæus**

**N. undulata Say.**

Central Park, New York City, April 30 and March 11 and 12; Delair, N. J., September 1; Bronx, New York City, September 9; Forest Park, R. I., November 7; Palisades, N. J., March 2 and 7, April 19, May 1 and 9, July 18, August 9, September 7 and October 10; Putnam Co., N. Y., September 5; Staten Id., N. Y., August 16, September 26 and October 25; Rahway R., Cranford, N. J., August 6 and 27; Ft. Lee Dist., N. J., September 18.

This is by far the most abundant form throughout the United States and locally. It occurs in common with the other species of the genus, from the time the ice melts in spring until the late autumn.

**N. variabilis Fieber.**

Central Park, New York City, April 12; Delair, N. J., Lakehurst, N. J., May 23 and 26; Palisades, N. J., March 7, May 9, July 18, August 22, September 7; Putnam Co., N. Y., September 5; Staten Id., N. Y., May 7 and 16, August 16, September 26; Van Cortlandt Park, New York City, March 28, April 11, 18 and 25, June 6, July 4 and 25, August 8, November 4, and October 1; Rahway R., Cranford, N. J., August 20 and 27; Westfield, N. J., July 4, 9 and 16; Fort Lee Dist., N. J., September 18.

This is a good species, although Prof. Uhler has long been of the opinion that it is conspecific with the preceding species. It also is very abundant where found. It

is practically the only species to be taken at Van Cortlandt. Very rarely single specimens are found in company with *Notonecta undulata*, and this is also true of the occurrence of the latter with the former. It is this insect that is recorded in Dr. Smith's list as *N. americana*, a bug that occurs only in the southern part of the country. *N. variabilis* is omitted in the list mentioned.

***N. uhleri* Kirkaldy.**

Palisades, N. J., May 5; Putnam Co., N. Y., September 5; Van Cortlandt Park, New York City, April 11, 18 and 25; Fort Lee Dist., N. J., May 14.

This extremely beautiful crimson and black species, mentioned in my first notes on this family\* as likely to occur in this vicinity, I myself had the pleasure of finding at Van Cortlandt Park, making the first published record of the species in this State, and indeed, the first mention of it outside of the type localities. My catch in the localities mentioned constitutes the majority of the specimens in collections. This is a very rare bug, but very readily separable from any other American species.

***N. irrorata* Uhler.**

Delair, N. J., Bronx, New York City, September 30; Forest Park, R. I., November 7; Palisades, N. J., July 18, August 9 and 23, September 7 and 25, October 10; Putnam Co., N. Y., September 5; Staten Id., N. Y., August 2 and October 2; Van Cortlandt Park, New York City, April 11, 18 and 25, June 6 and July 25; Rahway R., Cranford, N. J., August 6, 20 and 27; Fort Lee Dist., N. J., September 18 and October 22.

This bug is not uncommon in dark waters, hiding among stems and roots growing in the water.

***N. insulata* Kirby.**

Delair, N. J.; Palisades, N. J., May 1, August 9 and 23; Staten Id., N. Y., September 26.

This species is not very abundant. It may at times be found in company with *N. irrorata*, but ordinarily it seems to seek clear cold pools, where the water is deep

**Genus ANISOPS Spinola.**

***A. elegans* Fieber.**

Palisades, N. J., September 7; Staten Id., September 26; Van Cortlandt Park, New York City, July 25; Rahway R., Cranford, N. J., August 27; Fort Lee Dist., N. J., September 18 and October 22.

This is rather rare in this vicinity and may be found floating in the shallower waters of ponds, near the edges, among the weeds.

***A. sp.* (? *albidus* Champion).**

Delair, N. J.; Staten Island, N. Y., September 8 and 26, October 25, November 11.

This is the species erroneously identified by me as *Anisops platynemis* in my paper cited above. At the time this identification was made, I did not possess Fieber's

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\* "Notonectidæ of the Vicinity of New York," Journ. N. Y. Ent. Soc., Vol. X, no. 4, December, 1902.

“Rhynchotographien,” where the species in question is described. *Anisops platycnemis* is small, about 5 mm. long, while this bug is 7 to 8 mm., and, according to Fieber's description, approaches the preceding. This species is the most abundant in this vicinity.

**Genus PLEA Leach.**

**P. striola Fieber.**

Staten Id., N. Y., May 7 and 16, and September 26; Van Cortlandt Park, New York City, April 11, 18 and 25, September 13 and 19; Rahway R., Cranford, N. J., August 27; Westfield, N. J., July 16 and August 13.

This small bug is abundant from early spring until late fall, hiding among the fine-leaved aquatic plants and algæ, where it swims about in quest of its food, crawling on the stems and among the matted fibers. As far as I have been able to observe, this Hemipteron is a vegetable feeder.

In conclusion, for the information of those of my readers who have not collected about New York, I will give a few notes on the localities. Central Park, of course, is the well-known pleasure ground of New York City, right in the heart of it. There is a little lake at about 100th street and the west side of the Park, where I have taken most of the aquatics for which this locality is given. Van Cortlandt Park is also in the city, toward Yonkers, on the line of the N. Y. and Putnam R. R. It is far more wild than Central Park, and in the lake there I have made very good catches. This was drained this year, unfortunately, to make some “improvements” and the insects are gone. Land bugs I have taken along the edges of the lake, in the bushes and grasses growing between it and the railroad tracks, and also in a sandy spot between the tracks at a fork of the railroad. Mosholu is about a couple of miles north of Van Cortlandt Park, and in fact, the collecting grounds form a part of this park. The localities where collecting is done by the New Yorkers are a meadow about a quarter of a mile west of the station and the woods on the hillside and those through which a little stream runs on the other side. Staten Id., means the entire island, in its ponds and woods and fields. Palisades, N. J., stands for the region around Fort Lee, Grantwood, Edgemere, and the other small towns that are springing up, including also Leonia. Bronx is the northern part of New York City, which is still more or less of a wilderness, but rapidly building up.

## A LIST OF CAPSIDS FROM THE STATE OF NEW YORK, WITH THE DESCRIPTION OF A NEW SPECIES.

BY OTTO HEIDEMANN,

WASHINGTON, D. C.

- Miris instabilis* Uhl. — Mosholu.  
*Collaria oculatus* Reut. — Mosholu.  
*Collaria meilleurii* Prov. — Mosholu.  
*Phytocoris puella* Reut. — Staten Id., Mosholu.  
*Neurocolpus nubilus* Say — Ft. Lee, Mosholu, Palisades.  
*Lopidea media* Say — Ft. Lee, Mosholu.  
*Stenotus binotatus* Fabr. — Mosholu.  
*Calocoris rapidus* Say — Mosholu, Forest P.  
*Calocoris bipunctatus* Fabr. — Mosholu.  
*Lygus invitus* Say — Mosholu, Forest P.  
*Lygus pratensis* Linn. — Cortlandt, Staten Id., Mosholu.  
*Lygus pratensis* Linn., large var. — Mosholu.  
*Lygus flavonotatus* Prov. — Mosholu, Palisades.  
*Lygus pabulinus* Linn. — Staten Id., Mosholu.  
*Lygus monachus* Uhl. — Mosholu, Lakehurst.  
*Pæciloscytus basalis* Reut. — Mosholu, Lakehurst.  
*Pæciloscytus sericeus* Uhl. — Mosholu, Forest P.  
*Pæcilocapsus lineatus* Fabr. — Mosholu, Cortlandt.  
*Pæcilocapsus goniphorus* Say. — Mosholu.  
*Pæcilocapsus*, black var., Reut. — Mosholu, Lakehurst.  
*Deræocoris segusinus* Muell. (Reut.) var. *capilaris* Fabr. — Brooklyn, June 27, 1903.

Several specimens found, males and females, showing all the varying shades of black, red and orange, peculiar to this species. They agree exactly with the European specimens with which I compared them. This species is rarely seen in collections. Prof. Uhler has listed it in his Check-List of Hemiptera, and it is also recorded by Reuter as occurring in North America.

- Systratiotus americanus* Reut. — Mosholu, Forest P.  
*Capsus ater* Linn. — Cortlandt.  
*Monalocoris filicis* Linn. — Staten Id., Sandy Hook.  
*Pycnoderes insignis* Reut. — Staten Id.  
*Camptobrochis nebulosus* Uhl. — Mosholu, Ft. Lee.

- Hyaliodes vitripennis* Say. — Mosholu, Staten Id.  
*Dichroscytus elegans* Uhl. — Mosholu, Lakehurst.  
*Orthops scutellatus* Uhl. — Mosholu.  
*Diommatus congrex* Uhl. — Staten Id.  
*Dicyphus californicus* Stal. — Staten Id.  
*Halticus uhleri* Girard. — Staten Id.  
*Stiphrosoma stygica* Say. — Mosholu, Forest P.  
*Onychomenus decolor* Fall. — Mosholu.  
*Episcopus ornatus* Reut. — Mosholu.  
*Psallus juniperi*, new species.

Body elongate-oval, densely covered with fine golden hairs, interspersed with darker, erect, longer ones. Color pale-yellowish, slightly sprinkled with reddish. Head nearly vertical, short; broader across the eyes, which are prominent and reniform, touching the anterior border of pronotum. Face slightly rounded, broad, marked with four transverse, brownish lines, interrupted in the middle. These lines are sometimes indistinct, being covered by hairs. Antennæ nearly reaching the tip of cuneus; the joints equally stout, except the basal one, which is a trifle thicker, also shorter than the head and extending beyond the tip of head; second joint nearly four times longer than the first; the third two-thirds as long as the second, and the terminal joint somewhat longer than the first. Rostrum yellowish, reaching to the posterior coxæ. Pronotum trapezoidal, slightly convex, strongly declivous in front; anterior margin half the width of the posterior margin and a little sinuate in the middle; lateral margins not sharply marginate, somewhat depressed; the humeri subacute, rounded behind; the callosities very feebly indicated. Scutellum quite small, as long as wide. The sides of the hemelytra almost straight; clavus tinged with a reddish hue, which color extends in some bright specimens along the suture to the inner part of the corium; cuneus triangular, speckled with red, at tip whitish. The scutellum has near each basal angle a brownish spot, composed of tufts of hair. A linear spot at the apex of the clavus, and two minute spots along the posterior margins of the corium. Membrane fuscous and iridescent, considerably surpassing the abdomen; the veins of the cells white; close to the apex of the cuneus runs a short, hyaline line, exteriorly. Abdomen greenish-white, polished. Legs yellowish-white; the femora more or less mottled with red, the hind femora broad, compressed, and the hind tibiæ comparatively long, beset with fine white hairs and with dark, remote, long bristles. Claws very strong and blackish. Length to the tip of membrane 2.75 mm. Width across the hemelytra 1 mm.

Mosholu, N. Y., July 20, 1902 (de la Torre Bueno), 3 specimens, Crescent City, Fla. (E. A. Schwarz), Marshal Hall, Md., June 6, 1891, Front Royal, Va., August 6, 1893; Washington, D. C., June 9, 1891 (Heidemann).

*Type*. — No. 8199, U. S. National Museum.

This species is a small and a very frail insect, occurring during the summer months on red cedar (*Juniperus virginiana*).<sup>\*</sup> It has prob-

<sup>\*</sup> Proceedings of Ent. Soc., Washington, D. C., Vol. II., p. 225, 1892.

ably two broods, and hibernates in the adult state. This delicate Capsid may easily be recognized by its ornamentation of brown spots on the scutellum and hemelytra.

*Agalliastes associatus* Uhl. — Mosholu, Cortlandt.

*Agalliastes suavis* Reut. — Mosholu.

*Plagiognathus obscurus* Uhl. — Mosholu, Staten Id.

*Plagiognathus annulatus* Uhl. — Mosholu.

*Plagiognathus frater-nus* Uhl. — Mosholu, Forest P.

*Plagiognathus politus* Uhl. — Cortlandt, Mosholu.

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## Class I, HEXAPODA,

### Order XI, ORTHOPTERA.

#### A NEW SPECIES OF THE LOCUSTID GENUS AMBLYCORYPHA FROM KANSAS.

By A. N. CAUDELL,

WASHINGTON, D. C.

##### *Amblycorypha iselyi*, new species.

In size comparable with *A. rotundifolia* but differing from that species in having the elytra more rotundate and the wings aborted, not reaching the tips of the elytra, in this respect allied to the larger *parvipennis* of Stål. Ovipositor of about the same length and shape as that of *rotundifolia* but a little stouter. Pronotum flat above, the lateral carinae sharp and persistent. Hind femora extending considerably beyond the tips of the elytra in both sexes.

Length of pronotum, male, 7.5 mm., female, 8 mm.; elytra, male, 22.5 mm., female, 25 mm.; hind femora, male, 25 mm., female, 26 mm.; of hind femora beyond the tips of the elytra, male, 6.5 mm., female, 7 mm.; ovipositor, female, 10 mm.; width of elytra, male, 9 mm., female, 9 mm.; of pronotum, in front, male, 3.25 mm., female, 3.5 mm.; behind, male, 4.75 mm., female, 5 mm.

*Type*. — No. 8197, U. S. National Museum.

Described from two pairs taken at Wichita, Kansas, by Professor Isely in July, 1904.



# JOURNAL

OF THE

## New York Entomological Society.

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Publishes articles relating to any class of the subkingdom Arthropoda, subject to the acceptance of the Publication Committee. Original communications in this field are solicited.

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### EDITORIAL.

Within the last two years very rapid strides have been made in the knowledge of the North American mosquitoes both as adults and larvæ. Especially from the study of the latter, several unexpected results have appeared. Certain species, which had been determined by the students of the adults to be the same as European forms, turn out to be a mixture of several distinct species. *Culex cantans* is now divided into *C. fitchii*, *C. abfitchii* and "*C. cantans*"; *Culex reptans* is now called in America *C. trichurus*, *C. lazarensis*, *C. æstivalis* and *C. pullatus*; which is to say that these forms would scarcely have been regarded as distinct species from the adults alone on the characters heretofore in use. Now the questions arise, do these forms appear only in America, or are the European species equally composite, and, if so, are all the forms the same as the American ones, or all different, or partly the same and partly different? We want to know. Will not some one in Europe take up this matter and study the mosquito larvæ carefully with a view to the discrimination of species? Or must we ourselves plan an invasion of European territory?

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We regret that lack of space compels us to postpone articles by Mr. Snodgrass on the Coulee Cricket and by Mr. Caudell on some Mantids, to the June issue. We send out their plates herewith, however, and think that the delay will not cause any controversy, as there are no new species described in either paper.

Apropos of our use of headings of class and order to precede all articles, we have heard some criticism to the effect that it was an affront to the intelligence of the reader to inform him of such an "obvious" matter. We are, however, recently in receipt of a communication signed by the Secretary of the Smithsonian Institution on behalf of the international catalogue of scientific literature, requesting the class, order and family to which should be referred a short paper published by us in this JOURNAL before the above custom was adopted. If the compilers of bibliographies go to the trouble of correspondence with authors before they can list their works, it needs no further proof of the usefulness of our headings.

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### LIST OF ACTIVE MEMBERS OF THE NEW YORK AND BROOKLYN ENTOMO- LOGICAL SOCIETIES.

The following names were omitted from the list of members which was printed in the September issue (vol. XII, pp. 193-196) and should be added thereto: Aaron, Eugene, Br. Soc.; Cramer, A. W. P., 142 W. 87th St., N. Y. City, Br. Soc.; Fulda, Carl, M. D., 1096 Halsey St., Brooklyn, N. Y., Lepidoptera, Br. Soc.; Kalbert, John, 181 Russell St., Brooklyn, N. Y., Br. Soc.; Wood, Wm., 51 5th Ave., N. Y. City, Coleoptera, N. Y. Soc.

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### PROCEEDINGS OF THE NEW YORK ENTO- MOLOGICAL SOCIETY.

MEETING OF OCTOBER 4, 1904.

Held at the American Museum of Natural History. President C. H. Roberts in the chair with thirteen members and one visitor present.

The minutes of the preceding meeting were read and approved.

The treasurer reported that the Society and JOURNAL fund had now a balance of \$842.98.

Mr. Weeks reported that the Brooklyn Entomological Society was now affiliated with the Scientific Alliance of New York City, and suggested that the New York Entomological Society take some action in reference to holding but one meeting monthly.

Mr. William Wood, of 51 Fifth Avenue, was proposed as an active member by Mr. Leng.



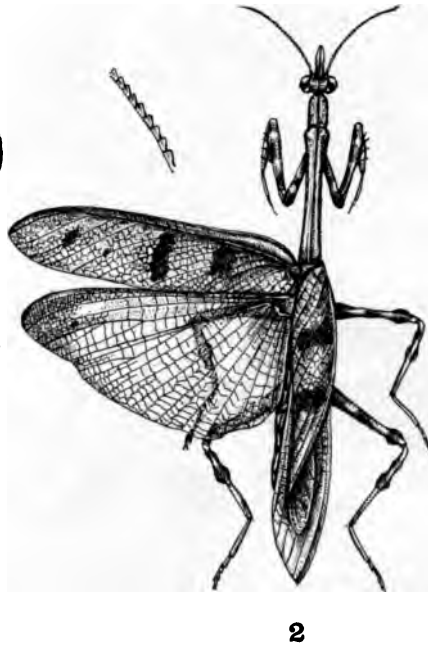
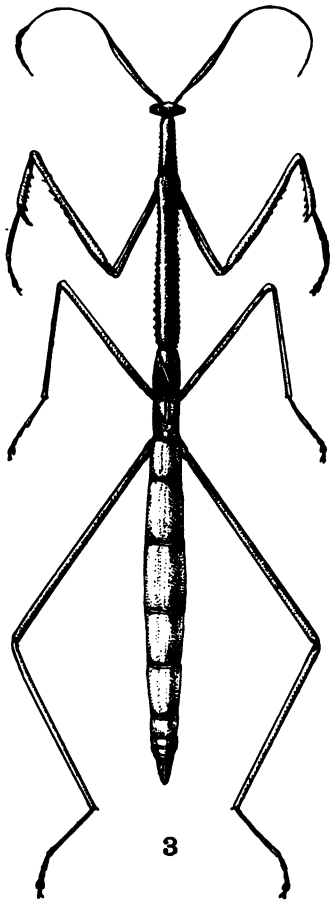
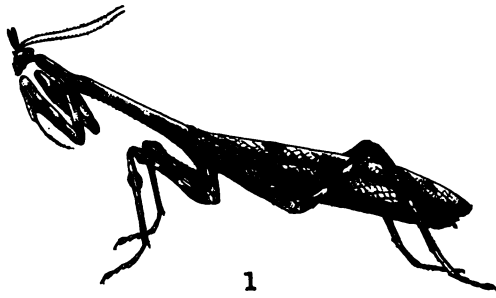
The Coulee Cricket.





The Coulee Cricket.

1



United States Mantids.





# THE NEW YORK ENTOMOLOGICAL SOCIETY.

Organized June 29, 1892.—Incorporated June 7, 1893.

The meetings of the Society are held on the first and third Tuesday of each month (except June, July, August and September) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Eighth Ave.

Annual dues for Active Members, \$3.00.

Members of the Society will please remit their annual dues, payable in January, to the treasurer.

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## JOURNAL

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Class I, **HEXAPODA.**

Order IV, **DIPTERA.**

**ILLUSTRATIONS OF THE ABDOMINAL APPEN-  
DAGES OF CERTAIN MOSQUITOES.**

BY HARRISON G. DYAR, A.M., PH.D.,

WASHINGTON, D. C.

(PLATES IV AND V.)

It has been shown by Mr. F. V. Theobald that the male genitalia of mosquitoes are of value for purposes of identification, and Dr. E. P. Felt has inaugurated the use of them in the definition of genera. Previous to Dr. Felt's work the genitalia of our species were little known and but few of them figured. It is the purpose of the present article to illustrate some additional species to those which Dr. Felt has made known.

**Deinocerites cancer** Theob. (Plate IV, Fig. 1.)

Side pieces stoutly conic, basal lobe strongly trifold; clasp thick, truncate, clawed at tip, hirsute on outer aspect. Harpe long, spatulate, smooth, unjointed. Harpago rounded, concave, crested by stout spines. Uncus slender, concave, nearly as long as the harpago. Appendage of the eighth segment undeveloped.

**Wyeomyia smithii** Coq. (Plate IV, Fig. 2.)

Side piece conic, bent from side view, rather transparent; two stout setæ within; clasp enlarged, membranous, inflated, irregularly lobed, with a few spines. Harpes and harpagoes likewise inflated

and irregular. Unci long with terminal teeth. Appendage of the eighth segment distinct, setose.

**Grabhamia æstivalis Dyar.** (Pl. IV, Fig. 3.)

Side piece elongate, outer lobe distinct and running well toward base; inner lobe rounded, spinous; clasp filamentous with long articulated terminal spine. Harpe jointed, basal part long, a little curved, uniform, apical filament small, less than half the length of the basal part. Harpago smooth, elongate, outer part narrow. Unci invisible. Appendage of the eighth segment distinct, setose.

**Grabhamia varipalpus Coq.** (Plate IV, Fig. 4.)

Side piece elongate, outer lobe undeveloped, inner rounded and bearing many long fine setæ; clasp filamentous with long terminal spine. Harpe jointed, basal part well curved, uniform, apical filament long, broad, as long as the basal part. Harpago smooth, elongate, outer part narrow for over half its length. Unci invisible. Appendage of the eighth segment distinct, setose.

**Grabhamia curriei Coq.** (Plate IV, Fig. 5.)

Side piece elongate, outer lobe distinct, reaching toward base; inner lobe rounded with short setæ; a stout terminal seta; clasp filamentous with long terminal spines. Harpe jointed, basal part slender, straight, terminal filament broad, as long as the basal part. Harpago curved, concave, narrowing outwardly. Unci invisible. Appendage of eighth segment narrow and elongate, setose.

**Pneumaculex signifer Coq.** (Plate IV, Fig. 6.)

Side piece elongate, conic, no outer lobe, inner lobe a slight prominence, a stout curved seta on middle of inner side; clasp filamentous, slightly enlarged outwardly, articulated tip moderate, multiple. Harpe short, conic, concave with trifid apex. Harpago bent, concave with notched tip. Unci invisible. Appendage of eighth segment undeveloped.

**Stegomyia fasciata Fab.** (Plate V, Fig. 7.)

Side piece short, conic, scarcely longer than wide, without lobes but the inner area finely setose; clasp moderate, constricted somewhat near base, the articulated tip short. Harpe long, broad, chitinous, unjointed, curved at tip and with a branch inwardly near base, smooth. Harpago basal, short, broad, slightly dentose at tip. Uncus a small setose lobe. Appendage of eighth segment undeveloped.

**Feltidia cyanescens** Coq. (Plate V, Fig. 8.)

Side piece elongate conic, basal lobe very slight, setose; clasp thick, inflated, reticular, the tip narrowed with a short spine. Harpe curved, concave, spined at tip. Harpago cylindrical, truncate. Appendage of eighth segment undeveloped.

**Feltidia signipennis** Coq. (Plate V, Fig. 9.)

Side piece elongate conic, basal lobe rudimentary, setose; clasp thick, inflated, reticular, the tip narrowed with a short spine. Harpe curved, concave, slightly spined at tip.\* Harpago cylindrical, truncate. Appendage of eighth segment undeveloped.

**Theobaldia incidens** Thom. (Plate V, Fig. 10.)

Side piece elongate, conic, lobes undeveloped; clasp filamentous with minute terminal spine. Harpe bent at tip, stout, uniform, with irregular teeth. Harpago cylindrical, truncate. Unci invisible. Appendage of the eighth segment broad, large, setose. A row of very few short tooth-like spines at the tip of the seventh segment.

**Melanoconion atratus** Theob. (Plate V, Fig. 11.)

Side piece thickly conic, lobes continuous, the outer with a leaf-like scale, the inner with stout articulated spines; clasp enlarged at the base, slender outwardly, with minute terminal spine. Harpe stout, concave, narrowed at tip. Harpago small, slender. Unci and appendage of the eighth segment invisible.

**Culex tarsalis** Coq. (Plate V, Fig. 12.)

Side piece elongate, outer lobe distinct, with leaf-like scale and stout spines recurved at tip; no basal lobe; clasp filamentous, curved, with minute terminal spine. Harpe conic, heavily spined at tip; an additional pair of appendages at base with trifid apex. Harpago broad, acuminate. Uncus long concave, narrowed outwardly. Appendage of the eighth segment stout and broad, setose.

EXPLANATION OF PLATES IV AND V.

Genitalia of mosquitoes, the parts of one side only shown.

1. *Deinocerites cancer* Theob. from Jamaica.
2. *Wyeomyia smithii* Coq. from Massachusetts.
3. *Grabhamia astivalis* Dyar from British Columbia.

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\* The apparent difference in the direction of curve in the harpes shown in figures 8 and 9 is apparently unimportant, as I have another slide of *signipennis* in which the curve is inward as in *cyanescens*.

4. *Grabhamia varipalpus* Coq. from British Columbia.
  5. *Grabhamia curriei* Coq. from California.
  6. *Pneumaculex signifer* Coq. from Virginia.
  7. *Stegomyia fasciata* Fab. from Texas.
  8. *Feltidia cyanescens* Coq. from Texas.
  9. *Feltidia signipennis* Coq. from Mexico.
  10. *Theobaldia incidens* Thom. from British Colombia.
  11. *Melanoconion atratus* Theob. from Jamaica.
  12. *Culex tarsalis* Coq. from California.
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## NEW NEMATOCEROUS DIPTERA FROM NORTH AMERICA.

BY D. W. COQUILLETT,  
WASHINGTON, D. C.

The present paper is founded primarily on collections made during the summer of 1903 by Messrs. R. P. Currie, H. G. Dyar and A. N. Caudell in British Columbia, and by Mr. H. S. Barber, chiefly in northern California. Messrs. Currie and Barber paid especial attention to the Diptera and succeeded in obtaining many rare and interesting specimens. Only those belonging to the section Nemocera have as yet been studied and the descriptions of the new species are appended herewith. To these are added descriptions of several species received from various sources, bringing the number of new species described in this paper up to 41.

### *Dicranomyia signipennis*, new species.

Distinguished from the described species by the spotted wings in connection with the short auxiliary vein, the apex of which is very near the base of the second vein. Brown, the humeri, scutellum, a spot in front of it, the genitalia, halteres and legs, yellow, a black band before apex of each femur, apices of tarsi brown. Antennæ reaching nearly to base of wings, joints three to thirteen of nearly an equal length, the last three or four of these slightly longer than wide. Thorax opaque, grayish pruinose, mesonotum marked with three blackish vittæ. Hypopygium of male rather small. Halteres not unusually long. Wings glabrous indistinctly mottled with pale gray and whitish hyaline, stigma brown, a brown cloud at apex of auxiliary vein, another at forking of second and third veins, one on vein at base of discal, extending over small and hind crossveins, a fourth on veins at apex of discal cell; marginal crossvein close to apex of first vein, auxiliary crossvein close to apex of the auxiliary vein, first section of second vein one and one half times as long as first section of the third, base of discal cell far beyond base of the submarginal, discal cell closed. Length 7 mm.



Eureka, Cal. A specimen of each sex collected in coition June 5 by Mr. H. S. Barber. Type No. 8343, U. S. National Museum.

***Limnobia maculicosta*, new species.**

Marginal crossvein far before apex of first vein, wings spotted, femora without brown bands. Head and its members brown, the labella yellow, joints of antennæ except the second longer than broad, the eighth over twice as long as broad. Thorax somewhat polished, brown, varied with yellow. Abdomen brown, a band near base of second segment, the extreme bases of the other segments, the genitalia and the broad bases of the segments of the venter, yellow. Legs brown, broad apices of the femora, both ends of the tibiæ and bases of the tarsi yellow. Wings hyaline, indistinctly mottled with pale gray and with four rather large, dark gray spots along the front margin — one at base of second vein, another at apex of auxiliary vein, a third on the marginal crossvein, the last one at apex of first vein; the first spot extends only to the auxiliary vein, the other three border the costa; auxiliary vein nearly reaches the base of the submarginal cell and apparently ends in the first vein, with the crossvein a short distance before its apex. Halteres brown, both ends yellow. Length 11 mm.

Kokanee Mt., British Columbia (altitude 8000 feet). A female specimen collected August 10 by Mr. R. P. Currie. Type No. 8344, U. S. National Museum.

***Limnobia bestigma*, new species.**

Near *tristigma* but with only two brown costal spots — one at apex of auxiliary vein, the other on the marginal crossvein. Head and its members brown, the third joint of antennæ and the labellæ yellow; joints of antennæ except the second longer than broad, the fifth and following joints over twice as long as broad. Thorax somewhat polished, yellowish, a median brown vitta on the anterior half, sides of scutellum also brown. Abdomen brown, a median vitta, the genitalia and venter yellow. Legs yellow, broad apex of each femur and tarsus brown, an indistinct brownish band at a considerable distance from the apex of each femur. Halteres elongated, yellow. Wings hyaline, a rather small brown cloud at apex of auxiliary vein and a slightly larger one on the marginal crossvein; the latter cloud is located nearly in the middle of the otherwise pale yellowish stigma; apex of auxiliary vein slightly beyond middle of first section of second vein, its termination and the crossvein as in the preceding species; marginal crossvein far before apex of first vein. Length 9 mm.

Bear Lake, British Columbia. A female specimen collected July 29 by Mr. R. P. Currie. Type No. 8345, U. S. National Museum.

***Rhypholophus divergens*, new species.**

Near *holotrichus*, but the sixth and seventh veins diverging toward their apices, etc. Black, the halteres, trochanters and bases of the femora, yellow, ovipositor of female also yellow. Antennæ of male reaching slightly beyond base of wings, the third joint as broad as long, the eighth and following joints somewhat longer than broad. Thorax densely gray pruinose, not vittate, its hairs and those of the abdomen yellowish; hypopygium rather small, the claspers terminate in a curved hook.

Wings hyaline, stigma pale brown, discal cell opens in the second posterior, sixth and seventh veins very strongly diverging toward their apices. Length 4 mm.

Kaslo (June 18 and 29, R. P. Currie); London Hill Mine, Bear Lake (altitude 7,000 feet, July 21, A. N. Caudell), and Kokanee Mt. (altitude 9,000 feet, on snow August 10, R. P. Currie), British Columbia. One male and four females. Type No. 8346, U. S. National Museum.

***Molophilus nitidus*, new species.**

Base of first submarginal cell opposite base of discal cell, body polished. Black, a streak at each humerus and knobs of the halteres yellow, genitalia yellowish brown. Antennæ reaching base of second segment of abdomen, the third and succeeding joints longer than broad. Hairs of body chiefly brown; claspers consist of a pair of elongated, flattened projections tapering slightly to the apex, devoid of hooks and other processes. Wings grayish hyaline, marginal crossvein slightly beyond base of second submarginal cell, the latter opposite base of first posterior, base of third posterior cell noticeably nearer to base of first submarginal than to that of the second. Length 4 mm.

Fieldbrook, Cal. A male specimen collected May 18 by Mr. H. S. Barber. Type No. 8347, U. S. National Museum.

***Gnophomyia aperta*, new species.**

Discal cell open into the second posterior, hind crossvein at or before base of discal cell. Black, the halteres, trochanters and bases of femora yellow. Antennæ reaches base of third segment of abdomen, the third and following joints longer than broad. Thorax opaque, gray pruinose, mesonotum with a darker median vitta not reaching beyond the suture. Claspers short and robust, each with an apical horny hook. Wings grayish hyaline, apex of auxiliary vein opposite base of second submarginal cell, auxiliary crossvein subobsolete, about length of hind crossvein before apex of auxiliary vein. Length 4 mm.

Kaslo, British Columbia. Two males collected July 11 and 18 by Dr. H. G. Dyar. Type No. 8348, U. S. National Museum.

***Limnophila antennata*, new species.**

Near *quadrata* but the antennæ of the male reach base of sixth segment of the abdomen. Black, the halteres, genitalia coxæ, trochanters, femora and tibiæ except apices of the last two, yellow. Antennæ of male cylindrical but tapering to the apex, the third joint as long as the first two taken together, the following joints with a sparse verticil of short hairs near the middle of each. Head and thorax very thinly grayish pruinose. Wings grayish hyaline, stigma brownish, marginal crossvein near apex of first vein, first submarginal cell almost sessile, the second submarginal usually slightly longer than the first posterior cell, base of discal cell slightly nearer to base of wing than is that of the second submarginal, only four posterior cells, hind crossvein near middle of discal cell. Length 7 mm.

Kaslo, British Columbia. Three male specimens, two collected June 11 and July 11 by Dr. H. G. Dyar, the third collected June 22 by Mr. R. P. Currie. Type No. 8349, N. S. National Museum.

***Tricyphona aperta*, new species.**

Near *calcar* but the discal cell is open in the fourth posterior, etc. Yellow, the head black, gray pruinose, the antennæ, palpi and tarsi brownish toward their apices. Wings pure hyaline, stigma obsolete, first submarginal cell longer than the second, base of third vein far beyond the small crossvein, petiole of second posterior cell longer than this cell, subequal to preceding section of the fourth vein. Length 6 mm.

Kaslo, British Columbia. One male and two females collected May 29 and June 10 by Dr. H. G. Dyar. Type No. 8350, U. S. National Museum.

Family CHIRONOMIDÆ.

TABLE OF NEW SPECIES OF CERATOPOGON.

1. Third vein connected with the first by a crossvein..... 6  
 Third vein wholly separated from the first, not connected by a crossvein, wings bare, unmarked, fourth joint of hind tarsi at most one half as long as the fifth, claws of tarsi equal or subequal in length ..... 2
2. Last tarsal joint not spined on the under side..... 3  
 Last joint fringed with two rows of large spines on nearly entire length of the under side. Black, the broad bases of antennæ, palpi, scutellum, knobs of halteres, first two pairs of tibiæ except their apices, and the tarsi except apices of the joints and the whole of the last one, yellowish. Body opaque, gray pruinose. Femora rather slender, front ones spined on the apical half of the under side, the middle femora not spined, hind ones bearing about five rather slender spines toward the apex of the under side; tarsal claws very long, a large tooth before base of each. Wings hyaline, third vein ends near six sevenths length of wing, apex of first vein before middle of the third, fourth vein forks slightly before the small crossvein. Length 3.5 mm.....*setipes*.\*
3. Mesonotum polished and sometimes with gray pruinose vittæ..... 4  
 Mesonotum opaque, gray pruinose. Black, knobs of the halteres and the legs yellow, extreme apices of the femora, tibiæ and joints of tarsi brown, broad apices of hind femora and bases of their tibiæ also brown. Abdomen somewhat polished. Femora rather slender, the front ones slightly thickened and bearing three spines on the apical half of the under side, other femora without spines; tarsal claws rather large, not toothed. Wings hyaline, venation as in *setipes*. Length 2.5 mm.....*pruinus*.†
4. Dorsum of thorax unmarked..... 5

\* Brownsville, Texas. A female specimen collected March 19 by Mr. C. H. T. Townsend. Type No. 8351, U. S. National Museum.

† Bear Lake, British Columbia. A female specimen collected July 20 by Mr. R. P. Currie. Type No. 8352, U. S. National Museum.

Dorsum of thorax marked with a pair of whitish pruinose vittæ on slightly more than its anterior half, the sides, front angles and greater part of pleura thinly grayish pruinose. Black, bases of the joints of the tarsi yellowish. Abdomen somewhat polished. Femora rather slender, not spined. Wings hyaline, slightly tinged with yellowish in the marginal cell; third vein reaches three fourths length of wing, apex of first vein slightly before middle of the third, fourth vein forks nearly at the small crossvein. Length 2 mm.....*bivittatus*.\*

5. Abdomen on basal half yellow, legs chiefly yellow. Black, the halteres, basal half of abdomen, genitalia and legs except knees, apices of tibiæ and whole of last tarsal joint, yellow, a brownish band near middle of hind tibiæ. Mesonotum highly polished. Femora slender, without spines. Wings hyaline, third vein nearly reaches three fourths length of wing, apex of first vein near middle of the third, fourth vein forks slightly before the small crossvein. Length 2 mm.....*flavoniger*.†

Abdomen wholly black, legs chiefly black. Black, the basal half of the antennæ, the palpi, stems of halteres, a band before apex of each front femur, one near apex of first two pairs of tibiæ, and the tarsi, yellow. Body highly polished, thorax gibbous. Femora not spined, rather slender, the hind ones elongated and thickened toward the apices. Wings hyaline, venation as in *flavoniger* except that the apex of first vein is noticeably before middle of the third. Length 1.25 mm.....*gibber*.‡

6. Wings hairy, at least toward the apices.....14  
Wings bare ..... 7  
7. With at most a small brown spot on either wing, situated on the small crossvein.. 9  
With distinct brown markings on the wings..... 8  
8. Yellow, a pair of widely separated vittæ on the mesonotum, a streak beneath each wing, the front, lateral and hind margins of the abdominal segments beyond the second, the knobs of the halteres, apices of hind femora and of their tibiæ, also the last joint of their tarsi, black. Antennæ nearly as long as the body, the latter highly polished. Femora rather slender, not spined, first joint of tarsi longer than the following three together, the third slightly shorter than the fourth, the latter less than half as long as the fifth, which bears a pair of stout blunt spines near the base, one of the claws of each tarsus is more than twice as long as the other, the former being unusually long. Wings hyaline, a small brown spot extends from apex of first vein over the small crossvein, a second somewhat larger brown spot reaches from apex of third vein over halfway across the first posterior cell; third vein reaches three fourths length of wing, apex of first vein near one fifth length of the third, fourth vein forks far beyond the crossvein. Length 2 mm.....*pictus*.§

\* Eureka, Cal. Four females collected May 24 and June 6 by Mr. H. S. Barber. Type No. 8353, U. S. National Museum.

† Bear Lake, British Columbia. Two males collected July 20 by Mr. R. P. Currie. Type No. 8354, U. S. National Museum.

‡ Cayamas, Cuba. A female specimen collected January 16 by Mr. E. A. Schwarz. Type No. 8355, U. S. National Museum.

§ Virginia. A female specimen collected June 16, by Mr. Theo. Pergande. Type No. 8356, U. S. National Museum.

Black, the first two joints of antennæ, face, halteres, first two pairs of coxæ and their femora except their apices, the apical half of their tibiæ except the extreme apices, all tarsi except the last two joints, and basal two thirds of the hind femora, yellow. Antennæ longer than the body, the latter is highly polished, and with a white pruinose vitta in middle of the pleura. Femora rather slender, the middle and hind ones with two or three spinous bristles near the apex of the under side; first joint of front tarsi as long as the following three together, on the middle and hind tarsi it is as long as the remaining joints, fourth joint of hind tarsi slightly shorter than the third, about one half as long as the fifth, the latter not spined on the lower side, claws large, those of the front tarsi equal in length, on the middle and hind tarsi one claw is nearly twice as long as the other. Wings hyaline, a large spot extends the length of the third vein, and from the costa nearly to the hind margin of the wing, also a narrow border at apex of wing, blackish; third vein reaches five sixths length of wing, apex of first vein slightly before middle of the third, fourth vein forks rather far before the small crossvein. Length 3 mm.....*nubifer*.\*

9. Mesonotum polished, or at least not gray pruinose..... 10  
 Mesonotum opaque, gray pruinose and with a transverse row of four brown pruinose spots near the middle and with another brown pruinose spot a short distance in front of each of the outer spots. Black, the base of the antennæ, stems of halteres and the legs, yellow, the coxæ, apices of first two pairs of femora and of their tibiæ, the hind femora and their tibiæ, also the apices of the joints of all the tarsi, dark brown, scutellum reddish brown. Pleura gray pruinose, abdomen polished. Femora rather slender, the front ones slightly thickened and spined on nearly the entire length of the under side, middle and hind femora bearing three or four spines near apex of the under side; first joint of tarsi longer than the following three, the last joint of hind tarsi spined on the under side, claws large. Wings hyaline, third vein reaches five sixths length of wing, apex of first slightly before middle of third, fourth forks slightly before the small crossvein. Length 4 mm.....*slossona*.†
10. Abdomen black ..... 12  
 Abdomen chiefly yellow, tarsal claws equal..... 11
11. Blackish brown, the basal half of antennæ, the palpi, halteres, abdomen except first two segments, and the legs, yellow, the coxæ, greater part of hind femora, bases of middle and hind tibiæ and apices of last joint of tarsi, dark brown. Antennæ reaching slightly beyond base of abdomen. Mesonotum scabrous. Femora not spined, rather slender, the hind ones considerably thickened, first tarsal joint as long as the remaining joints together, none of the joints spined, claws rather large. Wings hyaline, third vein reaches five sixths length of wing, apex of first vein at middle of the third, fourth vein forks before the small crossvein. Length nearly 4 mm.....*magnus*.‡

\* Jacksonville, Florida. A female specimen collected by Mrs. A. T. Slosson. Type No. 8357, U. S. National Museum.

† Mt. Washington, N. H. A female specimen, collected by Mrs. A. T. Slosson, for whom this fine species is named. Type No. 8358, U. S. National Museum.

‡ Brownsville, Texas. A female specimen collected in May by Mr. C. H. T. Townsend. Type No. 8359, U. S. National Museum.

Yellow, the antennæ and palpi dark brown. Antennæ reaching slightly beyond base of abdomen. Mesonotum highly polished. Femora slender, not spined, first tarsal joint as long as the following three, last joint not spined, claws minute. Wings hyaline, third vein reaches two thirds length of wing, apex of first vein at middle of the third, fourth vein forks a short distance beyond the small crossvein. Length 8 mm .....*gilvus*.\*

12. Hind and other tarsal claws equal or nearly equal in length..... 13  
Hind tarsal claws very unequal in length. Black, the first antennal joint and base of the second, the halteres and legs, yellow, apices of femora, of tibiæ and of first three tarsal joints, also the whole of the last two joints dark brown. Antennæ reaching middle of abdomen, the second joint nearly twice as long as the first, the following joints at least twice as long as wide. Body highly polished, a white pruinose vitta above the coxæ. Femora slender, the first two pairs without spines, the hind ones with two spinous bristles near apex of under side; first joint of tarsi longer than the following three together, the last joint not spined, claws large, those of the first two pairs of tarsi equal in length. Wings hyaline, third vein reaches five sixths length of wing, apex of first near one third of the length of the third, fourth vein forks a short distance before the small crossvein. Length 3 mm.....*currici*.†
13. Hind femora strongly bowed forward, hind tibiæ chiefly yellow. Black, the head reddish brown, the first joint of antennæ and bases of the following nine, the stems of the halteres and the legs, yellow, the coxæ, bases of last two pairs of femora and of their tibiæ, also the last two tarsal joints, brownish black. Antennæ reaches middle of abdomen, the second joint slightly longer than the first. Mesonotum scabrous, pleura and abdomen polished. Femora rather slender, the hind ones considerably thickened, front femora bearing a single spine near middle of the under side, the others without spines; first joint of tarsi longer than the three following together, last joint of hind tarsi spined on the basal half of the under side, claws large. Wings hyaline, third vein reaches six sevenths length of wing, apex of first vein near one third length of the third, fourth vein forks slightly before the small crossvein. Length 3 mm.....*scaber*.‡  
Hind femora almost straight, their tibiæ black. Black, the halteres, front coxæ, trochanters, femora except their apices, and first three tarsal joints except their apices, yellow (front and middle tibiæ and their tarsi wanting). Body highly polished. Femora rather slender, not spined, first tarsal joint longer than the three following, last joint of hind tarsi spined on the under side, claws large. Wings hyaline, third vein reaches three fourths length of wing, apex of first

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\* Biscayne Bay, Florida. Three female specimens collected by Mrs. A. T. Slosson. Type No. 8360, U. S. National Museum.

† Kaslo, British Columbia. A female specimen collected June 17 by Mr. R. P. Currie, for whom this fine species is named. Type No. 8361, U. S. National Museum.

‡ Frontera, Tabasco, Mexico. A female specimen collected February 22 by Mr. C. H. T. Townsend. Type No. 8362, U. S. National Museum.

- vein slightly before middle of the third, fourth forks a short distance before the small crossvein. Length 2.5 mm.....*caudellii*.\*
14. Dorsum of thorax polished, not distinctly pruinose..... 15  
Dorsum opaque, usually gray pruinose, femora and tarsi not spined..... 16
15. Antennal joints two to nine connate, forming a single complex joint which is equal in length to the two following joints together. Black, the scutellum reddish brown, legs yellowish brown, bases of tarsi yellow. Antennæ robust, nearly reaching base of abdomen, the tenth joint twice as long as wide. Femora rather robust, with bristly hairs but no spines on the under side, first joint of hind tarsi as long as the following three, the fourth noticeably shorter than the third, about one half as long as the fifth, tarsi not spined, empodia large. Wings hyaline, almost wholly covered with hairs, third vein nearly reaches two thirds length of wing, apex of first slightly beyond middle of the third, fourth forks a short distance beyond the small crossvein. Length 1.5 mm.....*fusicornis*. †
- Antennal joints two to nine strongly narrowed at each end, together longer than the following five joints. Black, the knobs of halteres whitish, legs yellowish brown, bases of tarsi yellow. Antennæ scarcely reaches base of wings, joints two to nine wider than long, the following four scarcely longer than wide, the last joint nearly twice as long as wide. Body quite thickly covered with yellow hairs. Femora rather slender, not spined, first joint of hind tarsi as long as the following two, the fifth only slightly longer than the fourth, not spined. Wings hyaline, wholly densely haired, third vein reaches middle of wing, apex of first at two thirds length of the third, lower fork of fourth vein obliterated on its basal half. Length .7 mm.....*monilicornis*. ‡
16. Wings wholly covered with hairs..... 17  
Wings bare except toward the apex. Yellowish, the apical portion of antennæ, two rings before apex of hind femora, one near middle and the apices of hind tibiae, also narrow apices of joints of tarsi, brown. Antennæ nearly reaches apex of abdomen, joints three to nine considerably constricted toward their apices, slightly over twice as long as broad. First joint of hind tarsi as long as the following two, the fifth as long as the fourth and bearing a single long claw. Wings hyaline, a broad irregular brown crossband extends from apex of first vein to apex of lower fork of fifth vein where it is greatly narrowed; from this crossband a spur extends into the axillary cell and beyond its tip is a small brown spot; another spur extends toward base of second basal cell where it is enlarged and crosses the first basal cell; two other spurs extend outwardly in the second and third posterior cells, uniting with a large transverse brown spot; a slightly smaller brown spot at apex of third vein; third vein reaches

\* Bear Lake, British Columbia. A female specimen collected July 20 by Mr. A. N. Caudell, for whom the species is named. Type No. 8363, U. S. National Museum.

† Biscayne Bay, Florida. A female specimen collected by Mrs. A. T. Slosson. Type No. 8364, U. S. National Museum.

‡ Kaslo, British Columbia. Two females collected June 17 by Mr. A. N. Caudell. Type No. 8365, U. S. National Museum.

four fifths length of wing, apex of first near one third length of the third, the fourth forks a short distance beyond the small crossvein. Length 1 mm.

*maculipennis*.\*

17. Second joint of hind tarsi at most two thirds as long as the first.....18  
 Second joint as long as the first. Black, the antennæ yellowish brown, halteres yellow, legs brown, the knees, a ring above middle and the apices of the hind tibiae yellow, narrow apices of the tarsal joints whitish. Antennæ reaches base of abdomen, joints two to nine slightly longer than wide, the twelfth twice as long as wide. Wings densely haired, grayish and with a large whitish spot near apex of first three posterior cells, nearly whole of fourth posterior cell whitish; third vein reaches middle of wing, apex of first near that of the third. Fourth joint of hind tarsi as long as the fifth, claws small, equal. Length 1 mm.

*cinctipes*.†

18. First joint of hind tarsi slender, hind tibiae without a spine at apex..... 19  
 First joint of hind tarsi swollen, hind tibiae with a black spine at apex of inner side. Black, the basal half of antennæ, mouth parts, scutellum, halteres and legs, yellow. Plumosity of antennæ yellowish. Mesonotum thinly gray pruinose and clothed with golden yellow hairs. Legs rather slender, very hairy, first joint of hind tarsi nearly as long as the following two, the fourth slightly longer than the fifth. Wings hyaline, wholly densely haired, third vein reaches middle of wing, apex of first near two thirds length of third. Length 1.5 mm.....*calcaratus*.‡

19. Mesonotum black, almost velvety, the gray pruinosity scarcely apparent. Black, a yellow humeral dot and the scutellum brownish yellow, knobs of halteres chiefly yellow, legs dull yellowish or brownish. Antennæ of female reaching beyond base of abdomen, joints two to nine slightly longer than wide, the tenth over twice as long as wide; in the male the plumosity is black, tipped with gray. Hairs of body chiefly black. Second joint of hind tarsi two thirds as long as the first, the fourth slightly shorter than the fifth. Wings hyaline, nearly covered with hairs, third vein reaching slightly beyond middle of wing, apex of first near two thirds length of the third. Length 1 to 1.5 mm.

*tenebrosus*.§

Mesonotum densely gray pruinose. Black, the halteres yellow, the antennæ and legs dull yellowish. Antennæ of female reaches beyond base of abdomen, joints two to nine slightly longer than broad, joint ten three times as long as broad; plumosity of male antennæ blackish and with gray tips. Hairs of body chiefly yellow. First joint of hind tarsi as long as the following two, the fifth slightly longer than the fourth. Wings hyaline, a small white spot

\* Jacksonville, Florida. A female specimen collected by Mrs. A. T. Slosson.

Type No. 8366, U. S. National Museum.

† Biscayne Bay, Florida. A female specimen collected by Mrs. A. T. Slosson.

Type No. 8367, U. S. National Museum.

‡ Frontera, Tabasco, Mexico. A male specimen collected February 19, by Mr.

C. H. T. Townsend. Type No. 8368, U. S. National Museum.

§ Barba, Cal. Four males and three females collected May 22, 24 and June 3 by Mr. H. S. Barber. Type No. 8369, U. S. National Museum.



just beyond apex of third vein, the latter reaches two thirds length of wing, apex of first vein near four fifths length of the third, costal vein considerably widened near the apex. Length 1 mm. ....unicolor.\*

**Tanypus miripes, new species.**

Near *hirtipennis* and *pilosellus* but in these the fourth joint of the tarsi is slender and at least two thirds as long as the third, while the fifth is only slightly smaller than the fourth. Yellow, the antennæ, mouth parts, three vittæ on the mesonotum, the metanotum, and the front ends of the segments of the abdomen, brown. Plumosity of antennæ brown, the apices yellow. Body opaque, grayish, pruinose, the hairs yellowish white. Tarsi with rather long pubescence but not distinctly bearded, the front and hind ones slender and elongated, the middle ones rather robust, the last three joints rather short, the fourth about one half as long as the third, the fifth unusually small, wings densely haired, hyaline, a brown cloud on the small crossvein, in certain lights an indistinct brownish cloud in outer half of anal cell and a crossband of the same color near three-fourths length of wing; first vein forked a short distance before the apex, crossvein at apex of second basal cell situated slightly beyond base of upper branch of fifth vein. Length 4.5 mm.

Eureka, Cal. A male specimen collected May 22 by Mr. H. S. Barber. Type No. 8371, U. S. National Museum.

**Tanypus sinuosus, new species.**

Near *johnsoni* and *bifasciatus*, but differing from both by the very sinuous second brown crossband of the wings. Yellow, varied with whitish, the legs wholly whitish, the mouth parts, and in the male the antennæ except the first joint, a spot in front of each wing, a pair of spots in front of the scutellum, the front ends of the abdominal segments and nearly the whole of the last two segments, brown, in the female with three brown vittæ on the mesonotum, the median one divided in the middle by a yellow line. Plumosity of antennæ gray basally and yellow distally, appearing wholly yellow in certain lights. Body opaque, hairs yellow and with several brown ones on the abdomen of the male. Tarsi slender, fourth joint much longer than the fifth, front tarsi of male bearded with rather long hairs. Wings densely covered with hairs, hyaline, a faint brownish crossband passes over the crossveins and is expanded in the anal cell; a broader brownish crossband begins on the costa just beyond the forking of the first vein and extends almost to the upper branch of the fifth vein, then turns towards the base of the wing for a short distance and then again changes its course and reaches the hind margin of the wing just before the apex of the lower fork of the fifth vein; the proximal edge of the upper portion of this crossband is nearly on a line with the distal edge of the lower portion; an indistinct brownish cloud on apex of fourth vein and of upper branch of the fifth; first vein forked toward its apex, crossvein at apex of second basal cell slightly beyond the forking of the fifth vein. Length 2 to 3 mm.

Center Harbor (Aug. 3, H. G. Dyar) and Franconia, N. H.

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\* Eureka and Fieldbrook, Cal. Two males and eight females collected May 22, 31, June 3, 5 and 6 by Mr. H. S. Barber. Type No. 8370, U. S. National Museum.

(Mrs. A. T. Slosson). Three males and two females. Type No. 8372, U. S. National Museum.

***Tanypus nubifer*, new species.**

Distinguished by the spotted, bare wings. Yellow, the first antennal joint, palpi, three vittæ on the mesonotum, lower portion of thorax, the metathorax, and bases of abdominal segments, brown, the legs whitish. Plumosity of antennæ gray, but appearing yellowish in certain lights. Body opaque, gray pruinose. Tarsi slender, the fourth joint longer than the fifth, front tarsi bearing many long hairs. Wings bare, whitish hyaline, a brownish cloud on the small crossvein, two near middle of first posterior cell, one beyond middle of second posterior cell, one near apex of posterior branch of fifth vein and about four in the anal cell, some of the latter very faint; first vein forked before the apex, fifth vein forks a short distance beyond the crossvein. Length 3 mm.

Salt Lake, Utah. Two males collected June 26 by Mr. H. S. Barber. Type No. 8373, U. S. National Museum.

***Tanypus heteropus*, new species.**

Black, the halteres light yellow. Plumosity of male antennæ yellowish brown. Thorax opaque, mesonotum with three blackish vittæ; hairs of abdomen whitish. Tarsi not bearded, the fourth joint short and dilated, shorter than the fifth. Wings hyaline, bare, first vein simple, the fifth forks a short distance before the crossvein. Length 3 to 4 mm.

Pullman, Washington (March 26 and April 9, R. W. Doane); Las Vegas Hot Springs, N. M. (March 21, T. D. A. Cockerell); Mt. Washington, N. H. (Mrs. A. T. Slosson). Nine males and one female. Type No. 8374, U. S. National Museum.

***Tanypus tenebrosus*, new species.**

Near *pilosellus* but much larger, the body chiefly black, etc. Black, the antennæ of female except the first joint, the scutellum, sides of male abdomen, legs and halteres, yellow. Plumosity of male antennæ grayish brown, appearing partly whitish in certain lights. Tarsi slender, the front ones not bearded, the fourth joint longer than the fifth. Wings hyaline, densely covered with hairs, first vein simple, the fifth forks slightly before the crossvein. Abdomen of female spatulate, widest at the fifth and sixth joints. Length 3 to 4 mm.

Franconia, N. H. One male and two females collected by Mrs. A. T. Slosson. Type No. 8375, U. S. National Museum.

***Chasmatonotus fascipennis*, new species.**

Black, the bases of antennæ, middle of pleura, base of venter, halteres, trochanters and bases of femora, yellow. Body polished. Wings brownish, the base broadly, a broad crossband just beyond forking of the fifth vein, and the very narrow apical margin of the wing, prolonged along the posterior margin to the median crossband, whitish hyaline, the crossband changing to yellowish in front of the third vein. Length 1.5 to 2 mm.

Kaslo Creek, British Columbia. Thirty-five specimens, collected June 17 and 18 by Messrs. R. P. Currie and A. N. Caudell. Type No. 8376, U. S. National Museum.

***Chasmatonotus hyalinus*, new species.**

Yellow, the mesonotum yellowish brown and with a black dorsal vitta, abdomen dark brown, tarsi, tibiae and femora except their bases, pale brown. Body polished. Wings grayish hyaline, somewhat smoky in front of the third vein. Length 1.5 mm.

Eureka, Cal. A male specimen collected May 24 by Mr. H. S. Barber. Type No. 8377, U. S. National Museum.

Family MYCETOPHILIDÆ.

***Sciophila fuscipennis*, new species.**

Distinguished by the dark brown wings. Black, the femora, tibiae and bases of the tarsi and of the halteres, yellow. Mesonotum polished, its hairs chiefly yellow, the marginal bristles mostly brown, hairs of abdomen chiefly brown. First joint of front tarsi about two thirds as long as the tibiae. Wings dark brown, auxiliary vein terminates in the first near middle of the marginal cell, petiole of second posterior cell subequal in length to the small crossvein, fifth vein forks far before the small crossvein. Length 6 mm.

Kaslo, British Columbia. Two females collected June 1 and 10 by Messrs. H. G. Dyar and R. P. Currie. Type No. 8378, U. S. National Museum.

***Sciophila simplex*, new species.**

Near *calcarata* but the middle coxæ are without spines, etc. Black, the mouth parts, bases of antennæ, a humeral spot, base of venter, halteres, coxæ, femora, tibiae, bases of tarsi, and hind borders of abdominal segments of the female, yellow, hind coxæ usually marked with brown. Antennæ elongate, the joints beyond the second over twice as long as wide. Body opaque, densely gray pruinose, the hairs black. First joint of front tarsi slightly longer than the tibiae. Wings hyaline, auxiliary vein ends in costa near or beyond middle of marginal cell, petiole of second posterior cell about six times as long as the small crossvein, fifth vein forks slightly before the small crossvein. Length 4 to 6 mm.

Antoine Mine, McGuigan (July 26, Anderson), London Hill Mine, Bear Lake (July 21, 28 and 29, R. P. Currie and A. N. Caudell), and Kokanee Mt. (August 11, R. P. Currie), British Columbia. Ten males and one female. Type No. 8379, U. S. National Museum.

***Sciophila brevivitta*, new species.**

Near *obliqua*, but in that species the median brown vitta on the mesonotum extends to the scutellum, the petiole of the second posterior cell is as long as that cell, etc. Yellow, the upper part of the head, the antennæ beyond the fourth joint, three vittæ on the mesonotum, three spots on the pleura, the lower part of the metanotum,

broad hind margins of the first five abdominal segments and the whole of the following two, also the apices of the tarsi, black. Body polished, the hairs black; median vitta of mesonotum paler than the others, not extending on the posterior fourth of the mesonotum, divided in the middle by a yellow line; scutellum chiefly brownish. First joint of front tarsi slightly shorter than the tibiae. Wings hyaline, auxiliary vein ends in the costa near or beyond middle of marginal cell, petiole of second posterior cell less than half as long as that cell, fifth vein forks before the small crossvein. Length 4 mm.

Kaslo, British Columbia. Three males collected May 30, June 12 and 20 by Messrs. H. G. Dyar and R. P. Currie. Type No. 8380, U. S. National Museum.

**Anaclinia coxalis, new species.**

Black, the humeri, femora, tibiae, inner side and narrow apices of front coxae, and the halteres, yellow. Body somewhat polished, thinly gray pruinose, the hairs yellowish. First joint of front tarsi longer than the tibiae. Wings hyaline, venation normal. Length 5 mm.

London Hill Mine, Bear Lake (July 21, R. P. Currie, July 29, A. N. Caudell), and Kaslo (June 26, H. G. Dyar), British Columbia. Type No. 8381, U. S. National Museum.

**Lejomya hyalina, new species.\***

Yellow, the antennae except at base, a spot on the front, three spots on the pleura, middle of metanotum, hind margins of abdominal segments, also apices of tarsi, black. Body polished, the short hairs yellow, the longer hairs and bristles of mesonotum and scutellum chiefly brown. First joint of front tarsi as long as the tibiae. Wings hyaline, upper branch of fifth vein usually interrupted at the base. Length 4 mm.

Las Vegas Hot Springs, N. M. Four specimens collected August 11 to 14 by Mr. H. S. Barber. Type No. 8382, U. S. National Museum.

**Mycetophila vitrea, new species.**

Distinguished by the hyaline wings in connection with the presence of long bristles on the inner side of the middle tibiae. Black, the face, mouth parts, bases of antennae, halteres and legs, yellow, apices of tarsi brown. Body polished, the hairs yellowish, the bristles black. Lateral bristles of front tibiae shorter than greatest diameter of the tibiae, many of those on the other tibiae about twice this diameter, middle tibiae bearing a very long and a short bristle on the inner side, hind tibiae devoid of bristles on the inner side. Wings hyaline, tinged with yellowish and gray along the costa, auxiliary vein obliterated apically, fifth vein forks opposite the small crossvein. Length 2.5 mm.

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\* *Lejomya* Rondani, 1856, = *Lejosoma* Rondani, 1856, = *Glaphyrophtera* Wintertz, 1863, preoccupied, = *Neoglaphyrophtera* Osten Sacken, 1878.

Delaware Water Gap, N. J. (July 12, C. W. Johnson), and Kaslo, British Columbia (June 11, H. G. Dyar). Two specimens. Type No. 8383, U. S. National Museum.

***Ceroplatus terminalis*, new species.**

Near *clausus*, but the wings are distinctly marked with dark gray toward their apices, the united portion of the third and fourth veins is longer than the succeeding section of the fourth vein, etc. Yellow, the antennæ, an ocellar spot, a median pair of lines on the mesonotum which diverge strongly anteriorly and are united posteriorly, the knobs of the halteres and apices of the tarsi, brown. Antennæ about as long as the thorax, the last joint slightly longer than wide, the others wider than long. Wings hyaline, tinged with yellow along the costa, the apices broadly and hind margin from apex of axillary cell more narrowly bordered with dark gray, which is considerably prolonged along the posterior branch of the fifth vein, a lighter gray spot in apex of the first and of the second posterior cell, the gray color extends along the third vein to a point a short distance basad its upper branch, the latter terminates in the first vein a considerable distance before the apex, auxiliary crossvein slightly beyond the humeral, apex of auxiliary vein beyond the union of the third and fourth. Length 10 mm.

Kaslo, British Columbia. A male specimen collected July 16 by Mr. R. P. Currie. Type No. 8384, U. S. National Museum.

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**A CHIRONOMID INHABITANT OF SARRACENIA  
PURPUREA, METRIOCEMUS KNABI COQ.**

BY FREDERICK KNAB,

URBANA, ILL.

(PLATE VI.)

During the course of a season's work upon culicid larvæ the writer examined the liquid contents of many leaves of the pitcher-plant, *Sarracenia purpurea*. It was found that the water in these leaves contained, besides larvæ and pupæ of the mosquito *Wyeomyia smithii*, two other forms of dipterous larvæ. One of these was a large maggot of the brachycerous type, perhaps the larva of Riley's *Sarcophaga sarraceniae*, a species which he bred from the leaf contents of *Sarracenia variolaris*.\* The other was a small, pale chironomid larva.

The first material was collected on July 30, 1903, on the boggy shores of a pond a few miles from Westfield, Massachusetts. Of the pitcher-plant leaves examined none contained more than one of the

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\*C. V. Riley: Descriptions and natural history of two insects which brave the dangers of *Sarracenia variolaris*. (Trans. Acad. Sci., St. Louis, 1874, v, 3, p. 235-240).

large maggots. However in most leaves numerous individuals of the chironomid larva were present, indeed, they were often more abundant than the larvæ of *Wyeomyia*. In many leaves all three forms of larvæ were found associated. In some leaves the water was converted into an extremely foul liquid, through the decay of large insects that had been entrapped, and in such only the large maggot occurred. But the chironomid larvæ also can endure quite foul water, for in one case they were numerous in a leaf in which had been drowned one of the large *Spirobolus marginatus*.

The chironomid was at once thought to be an unknown form and received such attention as circumstances permitted. Some of the larvæ were reared and produced a little black fly which runs actively but does not take flight so readily as most of its allies. Specimens of the fly were sent to Mr. D. W. Coquillett and were described by him as *Metriocnemus knabi* in the Canadian Entomologist, vol. 36, p. 11. The genus *Metriocnemus* had not previously been reported from the North American continent, although it is a large and widely distributed one and species are known from Greenland and elsewhere in the Arctic region, Europe, South America and Australia. Apparently nothing has been made known regarding the early stages in this genus.

The larvæ of the present species live at the bottom of the water-filled leaf-cups of *Sarracenia purpurea*, burrowing in the closely packed débris composed of the fragments of decayed insects; evidently their food is from this source. These larvæ, unlike those of most species of Chironomidæ, make no tubes. Upon the first occasion only larvæ were found, but this is doubtless because the pupæ were not discovered in their unusual situation. Upon August 23 the locality was visited again and this time pupæ were found — in a most abnormal situation for a chironomid.

Upon the inner surface of the pitcher, just above the water level, was a mass of a clear gelatinous substance, and within this the pupa was suspended in a perpendicular position, head uppermost. Sometimes there were a number of these pupæ in a row, each in its own globule of jelly. When the larvæ pupate close to each other the gelatine secreted by them forms a confluent mass. The jelly mass of an isolated pupa is elongate, slightly flattened, and its lower end extends slightly into the water. So transparent is the jelly that the lower submerged end is scarcely visible, but its tip is indicated by a more opaque portion, which is the cast off larval skin. By this contact with the water the jelly mass is prevented from drying up before the imago can

emerge. When the imago is about to emerge the pupa wriggles to the surface of the gelatinous case. The fly is disclosed within two or three days after pupation.

The writer has found an account of one other species of Chironomidæ which pupates within a gelatinous case, but under widely different conditions. It is the European *Chironomus minutus* Zett., of which the early stages are made known by T. H. Taylor in Miall and Hammond's "The Harlequin Fly," p. 11-13. The larva of this insect pupates within a gelatinous case attached to a submerged stone in a stream. The case is perforated by a passage occupied by the pupa and by constant undulations of the pupal body a current of water is kept flowing through the case.

On the other hand, the larva of our *Metriocnemus* forms its gelatinous case above the surface of the water, and there is no passage through the gelatine, but the pupa hangs imbedded in the mass. The pupa, unless disturbed, remains motionless until the time of emergence. The pupa is remarkable also in the entire absence of breathing organs, usually present in chironomid pupæ either in the form of "trumpets" or as tufts of filaments. In the pupa of the above-mentioned *Chironomus minutus* the respiratory trumpets are present, but are extremely small. O. A. Johannsen, in "Aquatic Insects in New York State," has described the pupæ of two species of Chironomidæ, which apparently are also without breathing organs. The pupa of *Diamesa waltlii* Meigen is stated to be destitute of the thoracic respiratory appendages, but it is suggested that the three pairs of short hollow filaments at the tip of the last segment may have a respiratory function. In the description of the pupa of *Thalassomyia obscura* (Johan.) no mention is made of respiratory organs, and from the accompanying figure it is to be inferred that they are absent. While no direct statement is made of the pupal habitat of these two species, it appears that pupation takes place within the case previously occupied by the larva.

*Metriocnemus knabi* appears to have a wide distribution and its range is probably limited only by that of its host-plant. In addition to the locality first mentioned, a bog at Wilbraham, Mass., in which *Sarracenia purpurea* flourishes, furnished me both larvæ and pupæ on August 28, 1903. Early in the spring of 1904, Dr. Geo. Dimmock collected numerous larvæ of various sizes near Springfield, Mass. The larvæ, with those of *Wyeomyia smithii*, were found in the frozen contents of the pitcher plant leaves. Some of these larvæ, under the

influence of indoor temperature, soon pupated and the first imago appeared upon March 15 after a pupal period of three days. Larvæ of this species were collected from *Sarracenia* leaves by Dr. A. D. Hopkins at Boardman, N. C., on April 4, 1904.

In the collection of the Illinois State Laboratory of Natural History are larvæ taken from leaves of *Sarracenia purpurea* at Cedar Lake, Illinois, on June 19, 1892. From the data given it appears that the larvæ may be found at all seasons of the year and that there are no well marked broods. Development proceeds more or less rapidly, depending upon the necessarily variable food supply and upon the temperature. Like the larva of *Wyeomyia* that of *Metriocnemus* is extremely hardy and can linger a long time without food. Of those collected in August, and kept in the original liquid in a tin covered breeding jar, some were still alive early the following April and some few of these completed their transformation; the remainder however were all dead by the end of the month.

Following are descriptions of the larva and pupa of *Metriocnemus knabi*.

*Larva* (fig. 1). Form long and slender, of the ordinary chironomid type. Length about 7 mm. Color very pale yellow, the head and the appendages of the ninth abdominal segment bright brownish yellow. The body is sufficiently translucent to permit the dark digestive tract and the tracheal tubes (in the form of two silvery sinuate lines) to be readily seen. The tracheal tubes are well developed and may be distinguished through their whole course, until they break up into finer branches in the head and in the ninth abdominal segment. Head rather small, longer than wide, tapering slightly towards the front. The foramen very wide, broadly margined with black. Clypeus prominent, about half the width of the head. Eyes small, in front of the middle, almost lateral. Antennæ (fig. 2) inserted well forward, rather prominent, of four segments; the basal segment large and stout, about three times as long as wide; second segment very slender, about a third the length of the first; third segment still more slender and shorter than the second; fourth segment very small and slender, tapering to a point; upon the apex of the basal segment, inserted beside the second segment, is a large spine or appendiculate segment equalling in length the three outer segments. Mandibles (fig. 3) prominent, stout at base; the outer half slender, curved, tapering to a point and with four teeth upon the inner margin; basal portion greatly dilated and hollowed out, with a large opening upon the inner side; attached to the inner side near the base is a fan-shaped brush of 7 or 8 long hairs with a common base. Labrum (fig. 4) large and rounded, hinged to the head by a narrower flexible strip; the front of the labrum projects over and bears a number of spines and setæ; beneath, well forward and medianly, is a group of curious ciliate appendages and outward from these, a pair of stout curved appendages with densely tufted apices projects downward. These last mentioned appendages appear to correspond to the "mouth tufts" of mosquito larvæ. Beneath, the head is flattened and the epicranial plates are completely fused.



On each side of the mouth a large, broadly rounded, flat lobe projects forward, covering the base of the mandible. Scattered over its surface are a number of setigerous papillæ and along the inner margin several spines. At the apex are the minute rudimentary maxillæ. The labial (fig. 4) plate is very large with a median slightly toothed portion flanked on each side by five larger teeth. Overlapped by the labial plate, and of similar outline with it, is the hypopharynx which bears an elaborate arrangement of spines and setæ.

Body of 13 segments, of nearly equal diameter throughout. Prothoracic segment somewhat longer than the succeeding ones; anteriorly, upon its ventral surface is a large retractile proleg. This is very broad, about three fourths the width of the segment, and about half its length when extended. It is cleft for a short distance and the two lobes are crowned with a dense brush of coarse simple hairs. Behind these brushes are fine transverse ridges beset with minute spines, and these ridges are placed in a series of about twenty closely set rows. The meso- and metathoracic segments are short and almost fused together. There are no appendages of any kind until the ninth and tenth abdominal segments are reached (fig. 5). The ninth abdominal segment bears dorsally and ventrally a pair of tubular appendages, broadened at the base and bearing at the apex a group of six stout and long black setæ. The anal segment is short and less in diameter than the preceding ones. At its tip, dorsally, are four small leaf like blood gills and below these a pair of fleshy extensible prolegs. The prolegs bear a circlet of large hooks of varying shapes and nearly all of them dentate (figs. 6-11).

*Pupa* (figs. 12, 13). Form rather elongate. Length 3.5 to 4 mm. Color cream yellow, the disc of the thorax pale brownish yellow. Eyes ferruginous, the very small accessory eye black. Eyes prominent and near the apex of the pupa, the minute accessory eye below the compound eye and in contact with it. The antennæ pass behind the eyes in a prominent ridge. The wing pads extend nearly to the lower margin of the second abdominal segment. Segments 2-8 with a dorsal transverse ridge above the hind margin crowned by a crowded row of minute, rounded spines pointing backward; a ferruginous line along their base. A fine dark line defines the front margin of the scuta on these segments. Dorsally at the base of segments 3-8 there is an area densely clothed with coarse bristles, concolorous with the body. The ventral surface of the abdomen is glabrous. At the tip of the body are four rather small laminate appendages which are margined with ferruginous. The larger upper pair lies in a transverse plane, the lower pair is turned obliquely downward.

#### EXPLANATION OF PLATE VI.

##### *Metriocnemus knabi* Coq.

Fig. 1. Larva.

Fig. 2. Antenna of larva.

Fig. 3. Mandible.

Fig. 4. Labial plate, hypopharynx and labrum (a part of the overhanging dorsal surface of the labrum is seen above).

Fig. 5. Ninth and tenth abdominal segments of larva.

Figs. 6-11. Hooks of posterior prolegs.

Fig. 12. Pupa in its gelatinous case.

Fig. 13. Tip of pupal abdomen, dorsal view.

## A NEW MOSQUITO.

BY HARRISON G. DYAR,

WASHINGTON, D. C.

*Culex mitchellæ*, new species.

This form was collected by me in southern Georgia and Florida in temporary pools of fresh water. The adult resembles *sollicitans*, but the wing scales are wholly black, the first tarsal joint is devoid of a light colored median band and the light colored scales of the legs are pure white instead of yellow. Types, 61 specimens, U. S. National Museum, type No. 8407; one ♀ selected as the type is from Jacksonville, Fla., the larvæ in dirty recently dug holes along the railroad. Other localities are Green Cove Springs in temporary pools in the pines, Magnolia Springs in pools in swampy land, Kissimmee, in ditch, puddles and pools at the edge of swampy land, Pokatee, Fla., in a hole with old tin cans and rotton wood, and in the pine barrens of southern Georgia in a puddle by the railroad at a siding. The larva closely resembles that of *sollicitans*, but the air tube is considerably longer, being fully three times as long as wide, while the spines of the comb are unusually long and thorn-shaped.

It gives me pleasure to name this species in honor of Miss Evelyn G. Mitchell.

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### Class I, HEXAPODA.

#### Order XI, ORTHOPTERA.

## THE COULEE CRICKET OF CENTRAL WASHINGTON. (*PERANABRUS SCABRICOLLIS* THOMAS.)

BY ROBERT E. SNODGRASS,

STANFORD UNIVERSITY, CAL.

(PLATES I AND II.)

“Coulee Cricket” is a name that may be appropriately given in the state of Washington to the large cricket-like Locustid, *Peranabrus scabricollis* Thomas, that lives in such immense bands in the northern half of Douglas county. The name is fitting because the insects are found principally in or about the dry cañons known as *coulees*, the chief of which are two great gorges named Grand Coulee and Moses Coulee.

The insects are large, fat, soft-bodied creatures, about an inch and a half in length and of a dark reddish-brown color. The males (fig. 1) have very short wings used for stridulating only; the females (fig. 2) are wingless.

They live in bands of many hundred thousands, perhaps millions of individuals and have lately become a menace to crops. In most places they live on desert or "scab-land" areas where there is nothing of importance for them to destroy. Some of the bands, however, are migratory, and during the last few years have made their way into cultivated parts, doing considerable damage to unprotected fields of young wheat, and of course threatening with destruction any country in their line of march — for they clear off nearly everything as they advance.

One of these moving bands coming toward Waterville from the south side of the Badger mountains was visited by the writer the first part of June in 1903. A stationary band living about a mile and a half east of Coulee City was visited during the latter part of June in 1902, and the same site was visited again in June of 1903, but there were then no crickets to be found there. The crickets were observed also during July of 1902 from Coulee City south along the east side of Grand Coulee as far as the railroad station of Adrian.

Nothing has yet been recorded concerning the hatching of the eggs or the growth of the young crickets. By the first of June, however nearly all reach maturity and adult life continues from then until the middle of July.

The adult crickets are fat and lazy-looking creatures, living on the ground and in the low bushes of the arid region they inhabit. The majority of them keep moving about most of the time, but, except when migrating, they go in no general direction and the confines of the band remain pretty definite. On the other hand, many may be seen remaining motionless for a long time, especially while sitting in the bushes.

Their customary gait is a slow walk, but when disturbed they jump. Their rate of progression when on an ordinary walk is about ten feet a minute. When they jump they cover at one leap from three to four inches. They have no fear of a person and only get out of one's path to avoid being stepped on. If allowed to do so they will climb all over one's clothes and even to the top of one's hat. Workmen that learn to disregard them often become covered by them while working or standing in an infested field.

The males and females do not differ in their ordinary habits, except that most of the time the males perform a chirping stridulation with their short wings. The females are wingless and consequently silent. The usual chirps of the male are uttered in regular and rather slow succession, averaging between 90 and 100 a minute. One, while stridulating for three minutes, made 97, 97 and 96 chirps a minute respectively. When disturbed, they stridulate sharply and rapidly in short, quick series of chirps having a decidedly angry tone.

Their food may be said to consist normally of plants. In some places they completely strip the vegetation of leaves and blossoms, and, where migrating leave behind them a great tract of devastation. On the other hand, individuals in stationary bands may be watched for a long time and never be seen to eat of the plants they inhabit. Where such bands exist the vegetation shows no evidence of the presence of the insects. Although their appetite for plant food is thus rather erratic, and hard to account for in its variation, they have a liking for flesh that is insatiable and which, owing to the absence of other means for satisfying it, commonly leads to cannibalism. It is a frequent sight to see one or several individuals eagerly devouring one of their comrades, the latter generally not yet dead. They apparently never attack and disable a healthy individual, but, whenever one becomes injured or weakened from any cause his neighbors at once turn upon and devour him alive. Mercy or feeling for another's pain are sentiments they have no notion of. Since an individual does not die until almost completely destroyed, many gruesome sights may be seen. Such fragments as a head, one side of the body, the ovipositor and a leg or so remain alive, and the palpi and ovipositor move about and the legs kick until all is devoured.

A female was observed eagerly feeding on the viscera of a male who was lying on his back. She was pulling the intestine out through a hole in the side of the male's abdomen regardless of the kicking and struggling of the victim. Presently another male came along and shared in the feast, the poor male that was having his vitals pulled out of his body struggling still more desperately, but this did not appear to affect the appetites of his devourers. Soon the female pulled off a leg and sucked out the contents through the open end with great relish. Then she went back to feeding through the hole in the abdomen.

In another interesting case a male was seen carrying off a live head and thorax with most of the alimentary canal attached. Two other

individuals made pursuit, one catching hold of the protruding viscera and pulling out a long piece of intestine. The other pursuer immediately grabbed the other end of the piece and for a while they had a fierce tug of war for possession. Finally one gave up and the other ate the capture. Then both hurried again after the first one but he had made good his evasion.

Such cannibalistic sights are common. If an individual is injured and thrown among the others he is at once attacked and eaten. But fresh meat of any sort is devoured with equal avidity. During the early part of the mornings there are generally to be seen a large number of half dead females being eaten. The females apparently weaken and die on the morning after they lay their eggs. These spent females form the breakfast of a large number of the well ones.

The crop contents of several individuals taken in the midst of a cannibalistic meal consisted of a dark brown, pulpy mass. Many other crops taken from specimens of the Coulee City band contained the same sort of mass. In fact, only one was found containing vegetable matter—a green, pasty mass easily recognizable as plant food. Only one or two individuals were ever seen here feeding on vegetation; they appeared to subsist almost entirely on one another, especially on the females that succumbed in the mornings. This, however, as before stated, is not true of all the bands. Those in the Badger Mountains were seen voraciously feeding on vegetation, and in several places young wheat fields have been completely destroyed by them.

The large band that in the summer of 1902 was living about a mile and a half east of Coulee City was apparently a stationary colony. Residents in and about Coulee City said the crickets had been at the same place in about the same numbers for years back. They knew nothing of migratory habits in connection with them. The writer observed the females laying eggs here in abundance during June of 1902. When the site of the colony was visited again during the same month in 1903 not a cricket was to be found. Nobody knew anything about them except that they had not been seen as customary in other years. But no one could state whether they had hatched out in the spring and had later moved off, or whether the eggs never hatched. What actually became of this band is still to be determined.

The migratory bands live on the west side of Grand Coulee and have mostly started from the southern end of Moses Coulee. The writer visited one of these travelling hordes that had made its way in a

northeast direction across the Badger Mountains to within six or seven miles of Waterville by the 9th of June, 1903. A force of men was at work in front of them constructing a low fence to prevent their farther advance toward the wheat fields a mile or so beyond at the base of the mountains. These crickets were said to have travelled fifteen miles during the three weeks previous. Two years ago they came up out of the southern part of Moses Coulee and caused the farmers a great deal of trouble about Southside. Their migration this year toward Waterville from Southside over the Badger Mountains is their first visit to this region.

Where the crickets were checked by the fence they became densely massed and the vegetation was here utterly ravished by them. One could discern from a distance a striking contrast on the opposite sides of the fence. Evidently the insects here travelled for food.

During the morning and the early part of the afternoon the members of this travelling community behaved the same as those of the stationary Coulee City band. But the men at work along the fence confidently stated that between three and four o'clock in the afternoon the crickets would begin to travel, and that soon the ground would be covered by a dense crawling mass of the insects all moving steadily along in one direction. This prediction the writer saw verified the same day.

In any band the members are most of the time moving about but they simply go back and forth in any direction. Here, however, a little after three o'clock in the afternoon, many of the crickets were to be seen walking continuously along in a northeast direction. Toward four o'clock the number moving thus had greatly increased, while shortly after four not an individual was stationary—all were moving silently and steadily along in an unswerving course to the northeast. An average rate of progress was ten or twelve feet a minute. Feeding had entirely ceased and all individuals that were in the bushes came down to the ground which now became crowded. If any one lagged he was simply hustled along by those coming behind. Soon they became so massed that it was impossible for any one of them to go in any other direction than that of the crowd or even to stand still. Near the fence, which was placed across the predicted line of march the scene was something marvellous. Over thousands of square feet the crickets were simply massed together, there being on much of this crowded area actually a cricket to every

square inch of surface. About fifteen crossed any given point every minute. Between two points two inches apart one hundred and fifty crossed in five minutes, and, by another count ninety in three minutes, either giving thirty in one minute. This would be fifteen in single file. When they reached the fence they systematically turned to the right, *i. e.*, to the east, whether the ground sloped uphill or downhill, and travelled parallel with the fence. A few tried to climb over.

The fence consisted merely of six-inch boards set on edge, banked with earth on the side away from the crickets, and topped with a strip of tin projecting about an inch toward them and bent slightly downward. Many miles of this had been constructed in the Badger Mountains and it effectually kept the crickets back from the wheat fields in the valley below. By means of ditches and holes dug along the inner side of the fence enormous numbers of the insects were captured and killed. The moving horde simply flowed over the edges of these holes like some viscid liquid poured out upon the ground. Those on the rim of a hole were helplessly shoved over and in by the crowd coming behind, and in turn were followed by those that pushed them in. Thus they piled up until wagon-loads of them accumulated. Each hole soon contained a wriggling squirming, angry mass of life that extinguished itself through the fierce fighting and mutual smothering of the individuals thus heaped upon one another.

The average daily life of an adult individual is about as follows: The first half of the morning is spent in feeding, in walking about, or in silent meditation. From about ten o'clock until noon mating takes place between the males and females. During this act the male is beneath the female. The former while courting the female chirps continually with his wings and, advancing backward and obliquely sideways toward the female from in front, tries to push his abdomen beneath hers. Sometimes the female makes no resentment but often the male has his patience sorely tried. One was observed for twenty minutes attempting to make a female accept him before she finally did so.

Although the male is the active party during courtship the fertilization of the female depends on an act of her own. The ovipositor is directed downward or its tip braced against the ground; the opening of the bursa copulatrix behind the eighth sternum is then brought against the tip of the male's abdomen. After about five minutes a large white mass of tough albuminous matter is ejected by the male

into the bursa copulatrix of the female. The pair then separates but the white mass hangs from the abdomen of the female as a large bilobed appendage and apparently causes her much annoyance.

It is not evident what the function of this albuminous mass is, but it looks like simply a plug to close the bursa copulatrix. In the male a great mass of tubular accessory glands open into the ejaculatory duct and it must be these glands that secrete the albuminous mass.\* The female often keeps the tip of her abdomen elevated to prevent the mass from dragging on the ground, for, being sticky when fresh, it becomes covered with bits of leaves and grains of sand. She attempts to rid herself of it by bending her head beneath the abdomen and chewing it off. Others assist her by eating at it until after a short time it is gone. Seldom is one seen in the afternoon with the mass adhering while it is commonly present on females in the morning between ten and twelve o'clock. No cases of mating were ever observed in the afternoon.

Most of the afternoon is spent by the members of non-migratory bands in the same way as the early part of the morning. At about five o'clock, however, in both stationary and migratory bands, the females begin laying eggs and continue to do so until late in the evening. While ovipositing the female most commonly assumes an upright position, standing upon her hind legs beside a small bunch of grass and grasping the blades with the other legs for support (Fig. 3). The ovipositor is carefully forced down into the ground to its base. Strong peristaltic contractions of the abdomen now take place for a minute or so and then the ovipositor is withdrawn. Immediately, however, it is either poked down again into the same hole or thrust into a new place beside the first one. Thus the female continues placing a few eggs in one hole, a few in another and so on until a great many are laid about the roots of the same clump of grass. Often she quits one place and goes off some distance to another. In the migrating bands the females have much difficulty in depositing their eggs on account of the jostling and pushing of those moving past. Sometimes a female while ovipositing rests on the ground in the natural position and inserts the ovipositor by drawing the tip forward beneath her and then thrusting it downward into the ground.

The eggs are not inclosed in a case, each being entirely free and

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\* See Internal Anatomy of *Peranabrus scabricollis* by R. E. Snodgrass — Journal New York Entom. Soc., XI, p. 186, pl. XII, Fig. 8.



separate from the others. They are discharged from the tip of the ovipositor, passing slowly along its entire length, one at a time, by a slight movement of the blades upon one another. The latter spread apart at the tip as the eggs pass out.

After laying her eggs the female apparently weakens and dies during the day following. Early in the mornings there may be seen a great many weak or half dead females lying about or being devoured by the other members of the band. Nearly all the remnants of others that have been eaten during the morning are also of females, as is attested by the uneaten ovipositors.

About the middle of July, it is said, the crickets all die off, and this ends their history for the year. Toward the end of the season there must be a great preponderance of males, for the males were not observed to die off daily with the females. Nearly all males being eaten by others were injured individuals. In the migrating bands the next year's brood begins where the parent brood of the year before died off.

Only one natural enemy of the crickets was noted. This was a large black Pompilid, *Palmodes moris* Kohl., which during the season of 1902 inhabited in considerable numbers the outskirts of the Coulee City band. The wasps were seen everywhere flitting restlessly about amongst the crickets but no attacks on the latter were observed. One wasp was discovered in the act of dragging a female cricket over the ground to her burrow. The cricket was either dead or paralyzed to such a degree that it exhibited no sign of life and the wasp had her mandibles inserted into its head. On reaching the burrow the cricket was left outside for a few minutes while the wasp hurried below as if to see that all was properly prepared. She then came up and hauled the cricket down head foremost. Immediately afterwards she returned to the surface and flew away leaving the burrow uncovered.

Many wasps were seen filling the mouths of their burrows, but in only one such dug open was a cricket found. This was a female with the head upward. During the summer of 1903 not a wasp was seen anywhere.

No destructive remedy has as yet been successfully applied to these crickets. Experiments made by Professor C. V. Piper on inoculating them with the South African grasshopper fungus were unsuccessful as have been all other attempts to introduce this disease. The insects could probably be killed by rolling, burning, or by turning loose

turkeys and hogs amongst them, and they would certainly eat poisoned meat, but all of these methods are impracticable.

The only successful method of combatting the moving bands is that of fencing and dilating. The fences as already described effectively stop their advance, but to fence in all of the country that it is possible for the crickets to travel into would be an expensive undertaking. A great many can be trapped in the ditches but a few score-wagon loads of dead crickets does not appreciably diminish the number of the living.

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## TWO INTERESTING MANTIDS FROM THE UNITED STATES.

BY A. N. CAUDELL,

WASHINGTON, D. C.

(PLATE III.)

Among the members of the order Orthoptera occurring in the southern part of the United States, making collecting in that region so interesting as well as profitable, are the two species herein considered. Both being rare, one hitherto unrecorded from our fauna, the following notes, with accompanying figures, need no excuse.

**Brunneria borealis** Scudder. (Plate III, Fig. 3.)

*Brunneria borealis* Scudd., Can. Ent., XXVIII, 212 (1896); Cat. Orth. U. S., 13 (1900).

This species was described from a female nymph from the Gulf Coast of Texas, but in the original description mention is made of an adult female in the museum of Comparative Zoölogy at Cambridge. These two specimens have been examined. Besides these two specimens I have seen two adult females in the collection of N. Banks, taken in Brazos county, Texas, and one adult female is in the National Museum from Louisiana, taken by J. B. Coleman at Cowley in October, 1903. This latter specimen is the one figured. The male seems to have never been reported. It will very surely have elytra and wings about two thirds as long as the abdomen, thus agreeing with the other known species of the genus.

These females are very closely allied to the South American species *brasiliensis*, but the supraanal plate is somewhat more elongate, meas-

uring 3 mm. in length, seemingly more nearly allied in this particular to *B. subaptera*.

The cerci of the specimen figured were unfortunately absent and the defect in the drawing was not noticed until too late for correction. They should project beyond the tip of the supraanal plate a distance about twice the length of the latter.

*Vates townsendi* Rehn. (Plate III, Figs. 1-2).

*Vates* sp. Rehn, Trans. Amer. Ent. Soc., XXII, 221 (1901).

*Vates* sp. Caud., Proc. Ent. Soc. Wash., V, 165 (1903).

*Vates townsendi* Rehn, Proc. U. S. Nat. Museum, XXVII, 573 (1904).

As indicated by the above bibliography, this handsome insect was twice recognized in the immature state before the adult was made known. The type specimens were taken by C. H. T. Townsend at Zapotlan, Jalisco, Mexico. Its first recognition from the United States was as a nymph from Arizona, but recently the U. S. National Museum has acquired by purchase from the collector, Mr. E. J. Oslar, two mature males from Nogales, Arizona, collected on June 14 and July 18. These specimens are the ones here figured.

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## APLOPUS\* MAYERI, NEW SPECIES.

By A. N. CAUDELL,

WASHINGTON, D. C.

The Phasmid described and figured by the writer as *Haplopus evadne* of Westwood (Proc. U. S. Nat. Mus., xxvii, 950, 1904) is not that species, the male having been found to be brachypterous. A number of specimens of both sexes were taken in Florida, Dry Tortugas, Loggerhead Key, by Dr. A. G. Mayer. The specimen figured at the above reference is really a male and not a female as there stated. The restored tip of the abdomen however very well represents that of the true female as represented by specimens in the present collection. The female agrees in structure with the male except that the form is more robust and the pronotum and mesonotum are not so smooth and

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\* *Aplopus* was used prior to Gray's work by Megerle von Muehlfeld but seems to not have been used in a valid sense. Thus Gray's name is not invalidated by it. *Aplopus* being the original spelling, should be used, not the emendation *Haplopus* of Burmeister.

are more thickly spinose, the spines, however, smaller than those of the male. The antennæ of both sexes are about the length represented in the restoration in the figure, the basal segment quite strongly depressed, especially at the base, and considerably thicker than the succeeding ones, the entire antenna gradually tapering to a fine point. The elytra are generally tumid centrally. The males usually, but not always, have the abdominal segments laterally marked longitudinally with white and the margination of the elytra seems quite constant in that sex. As suggested in the former article, the chalky markings of the body are not constant. The end of the male abdomen is very moderately swollen, the seventh and eighth segments subequal, the ninth very slightly shorter, subquadrate, apically subtruncate, mesially very obscurely emarginate; the operculum reaching the apex of the eighth segment. The cerci are very stout, slightly recurved, cylindrical, bluntly terminated organs about as long as the ninth abdominal segment and directed backward, a little downward and scarcely inward. The intermediate and posterior femora of both sexes are usually armed for their entire length beneath on the median line with from five to seven black spines, the apical two moved forward to the anterior carina and opposite them, on the hinder margin, is a single small spine; all the femoræ have the geniculations spinose on both sides, those of the anterior pair the least developed. The anterior femora are armed below on the apical third with a couple of very small spines.

The measurements of a typical pair are as follows: Entire length male, 90 mm., female, including the oviscapt 125 mm.; antennæ, male, 53 mm., female, 45 mm.; mesonotum, male, 20 mm., female, 26 mm.; metanotum, male, 6 mm., female, 6 mm.; intermediary segment, male, 7 mm., female, 8 mm.; elytra, male, 7 mm., female, 8.5 mm.; anterior femora, male, 20 mm., female, 20 mm.; intermediate femora, male, 16 mm., female 17 mm.; posterior femora, male, 21 mm., female, 22 mm.; oviscapt, female, beyond the tip of the abdomen, 12 mm.; median width, mesonotum, male, 3 mm., female, 5.5 mm.; second abdominal segment, male, 2.75 mm., female, 5.5 mm.

Types in the Museum of the Brooklyn Institute of Arts and Sciences, Brooklyn N. Y., and cotypes in the National Museum, Washington, D. C.

In many particulars this species seems near *Aplopus micropterus* but the shorter wings and other less noticeable characters seem to separate them. It is also closely allied to *A. scabricollis* Gray, as

stated in a letter from Mr. W. F. Kirby, to whom specimens were submitted; but that is a larger species with a considerably longer oviscapt in the female. The location of this species in the genus *Aplopus* is merely tentative, the brachypterous males excluding it from this genus unless the male of *micropterus*, the type, is proved to be also brachypterous. In that case the species with macropterous males would necessarily take another generic name.

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### Class III, ARACHNIDA.

#### Order II, ARANEIDA.

#### CHANGE OF COLOR AND PROTECTIVE COLORATION IN A FLOWER-SPIDER. (*MISUMENA VATIA* THORELL).

BY ALPHEUS S. PACKARD, LL.D.,

PROVIDENCE, R. I.

My attention was called to this interesting subject in the summer of 1903, by observing the adaptation or "mimicry" of our common *Misumena vatia* Thorell (*Thomisus fartus* Hentz) to the hues of the petals of the daisy fleabane (*Erigeron annuus*) in blossom at Merepoint, Brunswick, Maine, July 18. It was then my impression that this spider was known to change its color, and I suppose that this took place within a short period—a few days at least—but on trying to find mention of such rapid or any other change of color I was unable to meet with any such notices. As for my own experience previous to last year I have only a vague recollection of seeing many years ago on a tree or flower a yellow *Misumena*. On inquiry of Mr. Nathan Banks, he very kindly called my attention to a brief note by James Angus in the American Naturalist, Vol. XVI, p. 1010, which says: "I suppose you know the little flower spiders, that conceal themselves in the flowers, and seize any unwary insect that may chance to come within their reach. I have generally found them white and yellow. I suspected they changed their color, and by experiment I find that this is so. If I take a white one and put it on a sunflower, it will get quite yellow in from two to three days. I believe they capture almost anything, but they seemed to be partial to the bees. I

found one the other day with a wasp ; the latter was not yet dead, but it was tightly held by the throat by the spider. The next day the wasp was found lying dead under the flower." Mr. Banks also wrote me October 7, 1903, as follows :

"I do not remember that there has ever been published any positive evidence that *Misumena vatia* or the closely allied *Runcinia aleatoria* ever change their colors. Of both species yellow and white specimens are found sometimes marked with red. I think Miss Treat once published a note to the effect that *Misumena* when placed on a different flower returned to its former flower. There is a case on record (Nature, 13 April, 1893, p. 558) where a Mr. Bell states that an African bluish spider when captured turned brownish, and afterwards gradually recovered its bluish color, perhaps from fright !

"Personally, I believe *Misumena* changes color, at least from white to yellow. From old notes I take the following : Early in the spring where the principal large flowers are white *Trillium* (wake-robin) I have found many white *Misumena* with a red stripe ; later, when the *Trilliums* were faded, there were many *Misumena* on the yellow dog-tooth violet ; these were all yellow, with red stripe. On this area were no white flowers then, and no *Misumenas* to be seen except on the *Erythroniums*.

"This, of course, is no proof, but evidence. I don't see anything strange or rather new if they did change color. For the young *Misumena* is neither white nor yellow, and without red stripes. Yet from these almost hyaline young grow spiders, some white, some yellow, some with red stripes. Therefore it would seem that their color depends upon their surroundings. If these surroundings can develop a yellow from hyaline, why not yellow from white ?

"I have seen *Misumenas* on flowers and plants with which their colors did not harmonize ; and there is variation in the shade of yellow and in size of red stripes and, with *Runcinias*, in the number of these stripes."

On the 18th of July, 1903, I detected a medium sized *Misumena vatia* holding in its jaws a green fly (*Lucilia caesar*). It had fastened its jaws in between the head and thorax, and there remained motionless several minutes until I touched the tip of the fly's wing, the fly being dead, and disturbed the spider so that it let the fly drop to the ground.

The flower of this fleabane is like an aster, *i. e.*, with a bright yellow center and pale, whitish lilac petals. The abdomen of this spider was yellowish and the head, thorax and legs pale whitish, but not snow-white, and more livid than the petals of the flower when the spider was resting directly on top, but when the legs were held obliquely so that the light was oblique, the hue or effect was exactly like that of the petals, so that it was a decided case of cryptic or protective mimicry.

A couple of days after I found several more half grown spiders on the same kind of flower, one had seized a small fly by the neck. One was found on the ox-eye daisy or white weed ; it sat on one side of

the yellow center, on the white petals; the fly alights on the flower, probes the yellow flowerets head-down, when it is seized by the neck and its blood is sucked; this spider and two others on the fleabane were all whitish, both cephalothorax and abdomen, the latter whiter than the cephalothorax and legs. No yellow ones were seen this season, but it did not occur to me to look for them on the golden rod.

I tried several experiments to see if these spiders would change colors. I enclosed one small one in a test tube on the red corolla of *Rudbeckia* for an hour, without any perceptible change, and again put six in the tube for a day without any change. Four of the *Misumena* were kept for four or five days in a bottle filled with wild rose leaves but no change was observed. They were fed with house flies and never appeared to see or notice the flies until the victim actually flew or ran directly into the jaws of the spider. Also in neither season did I find any reddish spiders on the wild rose.

The remaining observations were made at Merepoint, in July, August and September of 1904. On the 8th July of I found two on the buttercup; neither were yellow, but of the usual pale slightly greenish tint; a small one detected on the 12th was of a slight yellowish green. July 12 two decidedly white ones occurred on the buttercup, one with a red stripe on each side of the white abdomen. I placed two of them in a bottle filled with buttercup flowers, and kept them for three or four days without noticing any change of color. Four examples were collected from the ox-eye daisy, but none were yellow, one was whitish and the other greenish. One large one was yellowish green.

July 14 I put one in a box filled with heads of the ox-eye daisy, it was faint yellowish, while one in a test-tube with the same kind of flower is yellowish green. A rather large *M. vatia* was found with an *Andrena* bee 12 mm. long in its jaws.

I lined a glass bottle with tiger lily leaves and left a large white one with red lateral stripes in it for three or four days, but no change resulted.

After this, with the flowering of the golden rod, the prevalent color became yellow. The golden rods began to flower July 31, and on that day five small whitish ones with no yellow tinge were found on the freshly opened flowers. Four days after (August 4), when more *Solidago* flowers had opened six small spiders were picked off, and one half-grown spider all yellow, distinctly so, the cephalothorax and

abdomen above and beneath, and also the legs. This is the first yellow one I have seen for some years. The yellow hue is uniform, though the abdomen was a little deeper in hue than the rest of the body.

Two days later (August 6) the yellow ones had greatly increased in number with the blossoming of additional plants of the *Solidago*, for now ten yellow ones were found to one on the 4th.

The spiders were thoroughly well protected from observation, both by their pale yellow color, and by their habit of hiding among the greenish yellow calices of the flowers, not resting as a rule on top of flowers.

Was the change of color due to alteration of the pigment, or to color-preference? Had the yellow ones simply gathered on the newly opened golden rod and come from the yellow flowers? Evidently not, because there were no other abundant yellow flowers, the buttercup having mostly gone out of blossom, and the only other flowers on which they had been detected were the fleabane, ox-eye daisy, and wild rose, these being the commonest flowers at Merepoint.

During the latter part of August yellow ones prevailed on the golden rod. On the 12th I found three rather large yellow *M. vatia* on the golden rod, one large one striped on the side of the cephalothorax and abdomen. Only the young ones were whitish. It seems quite apparent that the yellow ones have more or less gradually changed, since they are not of the exact shade of yellow, the hues differing in intensity as if they had gradually become adapted to the change of color, and they are all yellow with a shade or tinge of green so that they are more in harmony with the general greenish yellow of the heads of the flowers among which they hide; as they are not, at first at least, of a uniform deep straw-yellow it is evidently a case of gradual adaptation, and not simple color preference, which assumes that the spiders were originally yellow and migrated to the *Solidago* from some other plants.

August 15 I found two small white ones on the golden rod and three or four yellow ones, and through the month middle and large-sized yellow ones occurred, with young colorless or whitish ones.

That they do change in consequence of adaptation to the yellow of the golden rod seems quite satisfactorily demonstrated by my beating from the golden rod, eighteen *M. vatia* into the umbrella, all of which were distinctly yellow, besides an additional small whitish one.



Afterwards at Intervale, N. H., on September 8 and 9, I found the yellow ones on *Solidago canadensis*, the most common species, and on *S. rugosa*, less common there, although this is the most common. Quite small yellow ones occurred, and at Providence several large deep uniform yellow ones.

Afterwards, on September 16, at Chocorua, five or six yellow *M. vatia* occurred on the golden rod (*S. rugosa*), one young *M. vatia* was yellow, the other greenish-yellow, all the young being distinctly yellow; one large example of a deep yellow. Not a single white half-grown or fully grown was seen.

September 17 in collecting I had the same experience as on the previous day; I found several young *M. vatia* which were yellowish and two large fully grown deep yellow ones, but no white ones occurred. On the red flowers of *Canna* occurred one full grown *M. vatia* with greenish cephalothorax and legs and a white abdomen. I beat the heads of a patch of life everlasting, comprising over 100 or 200 flowers, without finding a single spider on them, and none occurred in the few white and purple asters examined.

On reaching Providence, after considerable search I found but a single *M. vatia* on the golden rod, on the other hand *M. asperata* was the common species here, during the last week of September. Although the general effect is reddish, the ground color is pale yellowish; though in large ones the ground hue is often reddish. One yellowish one occurred on a small sunflower. It molted September 26. By the 4th or 5th of October, very few were seen, as they had apparently left the plants and gone into winter quarters.

At Chocorua yellow *M. asperata* occurred on the sunflower and also on a yellow gilly flower, or a similar plant.

*Occurrence of a white M. vatia on a white golden rod.* — At Intervale, N. H., I found two white ♀ *M. vatia* on the pale whitish golden rod (*S. bicolor*), and as stated above I found a white ♀ on the same species of golden rod at Providence. It was marked with red on the sides, as usual.

*Occurrence of M. vatia on the sunflower.* — At Intervale I found a large deep yellow spider of this species on the wild sunflower, *Helianthus decapetalus*.

*Experimental proof of change of color.* — On the 9th of August I enclosed two white *M. vatia* in a bag made of mosquito netting and tied over a head of the flowers of the golden rod. On the 15th on

opening the bag I found one which had grown larger, but still remained white, certainly not yellow.

August 20 I again opened the bag; the largest one was greenish white on the cephalothorax and legs, but the abdomen was pale yellowish; the smaller one had become yellowish all over, the body and legs distinctly yellowish, and the abdomen a little deeper yellow. This seemed a good test, and so far as a single experiment indicates, it shows that the change of color does occur in middle life, or when the spider is about half grown. The change evidently takes place in the pigment of the integument, as the result of exposure to yellow light reflected from the yellow flowers. In this way the spiders become adapted to their yellow environment.

The change requires certainly more than two or three days, *i. e.*, about a week or ten days. Thus on the 23d of August I placed a single white *M. vatia* found the day previous on the golden rod, in a bag containing a full head of yellow golden rods, and on opening it three days after (the 26th) it had not changed. On September 3 I opened the same bag and found the cast skin of the same white spider, the spider was not of full size, it was not distinctly yellow, being still whitish, with a greenish abdomen but slightly tinged with yellow. There was a dark green line on each side of the cephalothorax. Unfortunately the bag was not again opened, as I failed to return to Merepoint and was thus prevented from afterwards examining the specimen.

PREVIOUSLY PUBLISHED NOTES ON CHANGE OF COLOR  
IN FLOWER SPIDERS.

The foregoing observations were made and written out either before meeting with the published observations of others, or if read in former years they had been forgotten.

Besides the note published by Mr. Angus, Mrs. Mary Treat\* states that *Thomisus celer* which lives in the heart of roses is nearly of the same shade of color as the red flower, and that when the spider is "waiting for prey she cuddles down in the center of the flower and erects her legs, when it is almost impossible to distinguish them from the imperfect scattering stamens." Mrs. Treat also observed a spider catch a butterfly, and adds that she had often noticed the remains of of night-flying moths scattered near her, which she had evidently captured during the night.

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\* My garden pets, Boston, 1887, p. 12.

That butterflies may occasionally be seized and destroyed by these voracious spiders is farther proved by Mr. Firmen\* quoted by Mrs. Peckham. He once saw two butterflies "in the clutches of a spider," and on another occasion "witnessed the actual capture of a small blue butterfly (*Lycænestes*) by a white spider of the same genus" (*Thomisus*).

Returning to the subject of a change to rose-red, which I have not myself observed, Firmen mentions seeing at Cape Town a species "of the exact rose-red of the flowers of the oleander; and to more effectually conceal it, the palpi, tops of cephalothorax, and four lateral stripes on the abdomen, are white, according remarkably with the irregular white marking so frequent on the petals of *Nerium*."

Rev. O. P. Cambridge† has found *Thomisus onustus* pink when upon heather blossoms, and quotes Rev. C. W. Penny to the effect that it is yellow when upon yellow blossoms.

Prof. Edouard Heckel‡ has described and illustrated with two colored plates the color variations of *Thomisus onustus*—a species abundant in the south of France. This spider frequents the flowers of *Convolvulus arvensis*, and is so abundant during the months of August and September that nearly every plant has its spider; it is evident, therefore, that, in spite of the numerous insect visitors to these flowers, there must be a certain amount of competition for food among the spiders; this is especially the case if it be true that the spider limits itself almost exclusively to two Diptera, ignoring the other insects. The flowers of this *Convolvulus* show three varieties: one is pure white; another pink, with traces of a vinous red externally; while the third is a paler pink tinged with green externally. These three varieties of the *Convolvulus* are inhabited by three varieties of the *Thomisus* which correspond exactly in their hues with the flower, with the exception of the one which lives in the white flowers; this variety of spider has a blue cross on the abdomen, and the extremities of its legs are likewise bluish. Blue, however, may be suggestive of shadow, and not render the animal very conspicuous. These three varieties do not embrace all the colour modifications of which the spider is susceptible; it becomes a dark red when upon the flowers of *Dahlia versicolor*, which has a similar colour, and yellow when upon the flowers of the yellow *Antirrhinum majus*.

That I failed to find any bluish individuals is probably due to incomplete observations, since bluish individuals may yet occur in New England. That no pink ones occurred in the flowers of the wild rose examined may be due to the fact that those found by me may not have

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\* Protective resemblances and "Mimicry" in animals, p. 4.

† Spiders of Dorset.

‡ Bulletin Sc. France et Belgique, XXIII, 1891. Quoted from Beddard's Animal Coloration, p. 111.

been long enough exposed to the reflections of the roseate petals of this flower.

Beddard (Animal Coloration, p. 113) suggests that the yellow color of the *Thomisus onustus* is "not adaptation but simply due to age." It once occurred to me that this might be the case, but I think that the facts I have stated are more strongly in favor of a slow adaptive change, and it is disproved by the fact that old, fully grown white examples frequently occur throughout the last of the summer season.

Mr. Cook,\* referring to what was probably *Misumena vatia*, quotes from an article by L. C. Palmer, "an intelligent observer, but not a naturalist," to the effect that he found a species of spider near Philadelphia which was purple on the purple boneset, pure white on the white panicle of the boneset proper, while on the golden rods it was yellow.

In Italy Pavesi "finds that this same species when living on flowers is white, or white and yellow with red stripes on the abdomen; but that when found among the grass it is grass-green, with dark, obscure stripes on the cephalothorax and palpi." (Quoted by Mrs. Peckham, l. c., p. 88.)

Mr. Emerton† found *M. asperata* perched on a flower of sorrel (*Rumex acetosella*), its colors being exactly those of the flowers. In "The Common Spiders of the United States" (1902) he states that the *Misumenas* live on plants, among the flowers, especially on large flat clusters like those of carrot and thoroughwort. "Whether," he says, "spiders prefer flowers colored like themselves is an unsettled question; at any rate *Misumenas* of all colors and both sexes have been found in white flowers. Occasionally individuals are found on flowers of exactly the same color as themselves; for example, deep yellow *M. aleatoria* on the wild indigo *Baptisia tinctoria*, and the reddish *M. asperata* on the flowers of sorrel."

*The probable cause of the change of color.* — The change of color in the flower spiders appears to be due primarily to the direct action of the sun's light, and secondarily to the absorption of the color light-rays by the pigment of the integument. That it is obviously in no way the result of the food is evident, because these spiders feed upon the colorless blood of insects. We know nothing of the immediate cause of such changes, which occur during the life-time of the indi-

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\* American spiders and their spinning work, II, p. 368, 1890.

† Spiders of the family Thomisidæ, Trans. Conn. Acad., VIII, 1892, p. 370.

vidual, and are not transmitted to the offspring, beyond the fact that they are due to differences in the colorational environment, *i. e.*, the white, or yellow or pink hues of the flowers in which the spider hides or on which it rests.

The explanation of the cause must be sought in what we regard as a parallel case in the experiments initiated by T. W. Wood\* in 1867, and greatly extended by Professor Poulton,\* as described in his able essay "On the color relations between certain lepidopterous pupæ, and the variously colored surfaces immediately surrounding them." Mr. Wood found as the result of his experiment that "the skin of the pupa for a few hours after the caterpillar's skin has been shed is 'photographically sensitive,' " and "as might be expected, by putting the specimens in the sunshine at the time of changing, and surrounding them as much as possible with any desired colour, the most successful results have been obtained."

Professor Meldola has pointed out, says Poulton, that the theory of the moist, fresh, pupal surface as "photographically sensitive" was obviously a metaphor borrowed from the sensitive plate of photography and that there can be no real analogy between the two processes. Poulton concludes that the problem is essentially a physiological one, and that the physico-chemical changes are "merely the results of far more complicated physiological processes."

The question arises whether the change in *M. vatia* is connected with the molting period, but I have no observations which directly prove this. It is well known that many spiders with nearly each molt appear in different colors, or undergo some change in the markings.

#### *Summary of Results of My Own Observations.*

1. In the early part of the summer (June and July) when the greater mass of flowers are the white fleabane and the ox-eye (the wild rose and buttercups excepted) the spiders (*M. vatia*) are white and no yellow ones were detected.

2. Later in the season, towards the end of July (July 30-31), and early in August when the golden rod in Maine begins to flower, a few of the spiders are yellow, but by the middle of the month and through September they are almost without exception yellow, varying from a pale to a deep hue, probably due to the length of time they have been

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\* Trans. Ent. Soc. London, 1867, p. XCIX-CI.

† Philosophical Trans. Royal Soc. London, vol. 178, 1887, p. 311.

on or among the yellow flowers ; an occasional white one occurring which may have been a recent arrival from some bush or other plant.

This is an exact parallel with the instance observed by Mr. Banks, when the spiders occurring early in the spring in Virginia on the white trillium, afterwards become yellow on the yellow flowers of the dog-tooth violet, there being no white flowers in the neighborhood.

3. By enclosing a couple in a bag tied over a golden rod they have actually been found to change from white to yellow in the course of ten or eleven days.

4. There is an actual change in color, and the assembling of yellow spiders on yellow flowers is not a case of color-preference, but of a gradual alteration in the color of the pigment of the integument. Whether as in the case of lepidoptera, the change takes place at or directly after the time of molting has yet to be ascertained. I have no observations directly bearing on this question.

5. In rare cases (3) white *M. vatia* were collected on the white *Solidago bicolor*.

6. No *M. vatia* or any other species of Thomisidæ were found on blue or white asters or on life everlasting, of which hundreds were examined.

7. The result of the coloring, while in harmony with the color environment, is certainly not to protect the spider from the attacks of birds, as the only kind of spider-eating bird is the humming bird, other kinds of birds, as investigation shows, not feeding on spiders. On the other hand, the coloration is so far cryptic that flies and other prey of the spider less easily observe its presence. This, however, is quite a subsidiary matter ; without reference, so to speak, to the biological environment, the main fact is that the color of the spider is the mechanical result of exposure to an environment of this or that color.

8. The cause of the change of color is simply the action of light, and in the case, for example, of yellow individuals, to the reflection of yellow light from yellow flowers continued for a period of exposure varying from several days (three or four) to one or more weeks. There are multitudes of similar cases in other groups of animals, and protective coloration so-called is simply the mechanical result of the operation of a primary physical agent, *i. e.*, light.

The colorational change is not due to natural selection or to the survival of some one or even several fittest individuals, since hundreds

of thousands or great multitudes of individual spiders living on the golden rods of a vast area extending over northeastern America appear to become similarly affected when the golden rods come into flower.

In this case the color is not necessarily hereditary, since the young spiders are at first colorless, and when older whitish. The yellow hue persists only as long as the flowers are in blossom. Thus the yellow color variety persists only as long as the colorational environment is the same. Hence the natural selection theory seems quite inadequate and also unnecessary to account for the apparent mimicry, and the change of color is a clear case of adaptation to a color-environment, and is an example of Lamarckism, or what Eimer and others call orthogenesis.

Since this paper was sent for publication, we have read Keeble and Gamble's elaborate memoir on the color physiology of the higher Crustacea which fully confirms our view that color changes are primarily due to light and environmental changes. The change of color in the flower spiders seems to be an example of what Pouchet calls the "chromatic function." He experimented by placing shrimps (*Palæmon* and *Crangon*) in black and white dishes in broad daylight. On the black background the pigment cells expanded, and the resultant coloration was a dark one in harmony with the tone of the surroundings. On the white background they contrasted, and the consequent colorless place presented no contrast to the adjacent surfaces. Pouchet claims that the pigment movements were due to the stimulus of light, electricity and certain drugs, and he concluded that the background or color of the environment determined the movements of the chromatophores or pigment cells, through the mediation of the eye and nervous system.

His results have been confirmed and extended by Keeble and Gamble\* in their recent work, from which we have taken the above abstract of Pouchet's results. They also record that Jourdain (1878) pointed out that in addition to light, electrical and pharmacological stimuli, the temperature of the water influenced the color of sensitive crustacea, and that such changes were naturally independent of the action of the retina. Keeble and Gamble have shown (1900) that "rapid movements in the chromatophore could be induced by any decided stimulation; that slow changes followed the application of

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\* Phil. Trans. Roy. Soc. London, vol. 196, pp. 295-388. 1904.

less powerful stimuli, such, for example, as differently colored backgrounds in place of strongly contrasted ones; and that underlying these quick and slow reactions of the chromatophores to changes of environment, there was at least one intrinsic chromatophoric rhythm, the after effect of alternating night and day."

They confirm the view that light sets up movements of the pigments by its direct action on the chromatophores. "Light exerts a potent and varied influence on the littoral crustacea. Such animals as *Hippolyte*, *Mysis*, and *Palæmon*, instead of becoming inured, remain highly susceptible to the ever-changing light conditions of their environment." It also plays an important part in controlling not only the movements of these animals, but also the distribution of their pigments. The factors in pigment-movements are intensity, background or environment, and monochromatic light.

The color-phases in shrimps depend on different light conditions. In darkness the pigments of *Palæmon*, etc., are so contracted into their chromatophore-centers, that the latter appear as minute dots, resulting in a transparent phase. The rapidity with which the change takes place varies from ten or a less number of minutes to an hour or two.

What the authors call the "white background phase," *i. e.*, a transparent condition, the pigments being freely contracted, may be and generally is assumed with great rapidity, less than a minute often sufficing to call it forth in *Hippolyte* or *Macromysis flexuosa*. Here we might add that Pouchet found that in the turbot under certain conditions the color changes are only developed after a period of several days. Very pertinent to the matter of change of color in spiders and insects are the author's conclusions as to the environmental or background effects on littoral crustacea. "The background effects on pigment-movements, help us," they say, "to imagine how light modifies pigment-development and thus causes such an animal as *Hippolyte* to 'give into' its surroundings, modelling its diurnal pigment distribution on the distribution of light and shade on its background." They add: "As long as its background is unchanged, change of intensity avails little. Now of all things which characterize *Hippolyte* its tenacious immobility on the weed of its choice is the most striking."



JOURNAL  
OF THE  
**New York Entomological Society.**

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Publishes articles relating to any class of the subkingdom Arthropoda, subject to the acceptance of the Publication Committee. Original communications in this field are solicited.

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EDITORIAL.

In the December issue (Vol. xii, p. 254) the figure labelled to represent *Caddo glaucopis* should be transferred to *C. boopis*, as Mr. Crosby has informed us.

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Contributors to the Journal will please take notice that they can have separates of their articles printed in any number and in any form at cost, by notifying the editor sufficiently in advance. The publication committee has found it necessary to discontinue the sending out of reprints free of other matter, as was done with volume xii. Authors who do not notify otherwise, "shall be entitled to 25 copies" and will usually receive 50, without change of form, which means that there will generally be some foreign matter at the ends.

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The scope of P. Wytzman's "Genera Insectorum" is, in the portion on Lepidoptera, much the same as Hampson's "Catalogue Lepidoptera Phalaenae," but the treatment of species is far less complete and satisfactory. It includes the butterflies, as Hampson does not. If the subject were to be pushed energetically, it would result in a practical duplication of Hampson's work, which we think would be a waste of effort. An advantage would accrue to the student if the families to be first treated were those which Hampson will reach last, and at the present rate of publication, not reach for many years, namely, the Tineoid groups. However, there has been no evidence till lately of any intention to push the subject energetically. We have had before us some small fascicles in which several authors have treated of sundry of the smallest groups they could find; the Liby-

theidae by Pagenstecher, the Epicopiidae by Janet and Wytzman, the species or varieties of *Leptocircus* by Wytzman and the *Ornithoptera* by Rippon. These papers are too short to require serious comment, except that we would blame the editor for allowing such a caricature of a synoptic table as that of the *Ornithoptera* genera to get into print. Mr. Rippon has evidently not the faintest idea of how a table ought to be constructed, and, until he will take lessons in the rudiments of entomological carpentry, his large knowledge of and great interest in the most beautiful of all the butterflies will be prejudiced in the eyes of his fellow workers.

Finally we come to the first serious publication, the Hesperiidæ, by P. Mabille, covering 210 pages. The treatment seems both thoroughly advanced and conservative, although badly hampered in places by lack of material. For example, some of the American genera of the subfamily Pamphilinæ, section B, are given in a separate synoptic table, as the author had not the material to properly correlate them with the rest. The index is given in an excellent form but is incomprehensibly divided in two parts and it has a number of omissions. The treatment of the North American species is disappointing. Seventy-five out of our nominal two hundred species are entirely omitted. We are at a loss to imagine any adequate reason for this, as the author includes several lists of "species incertæ sedis" and we should look for our missing species there if the author had been unable to recognize them. It looks like a failure to properly study the literature. We hope to be able to return to this subject and assign these seventy-five species to their proper genera. We are sorry to note some inconsistencies in the synoptic tables. For example, in the table on pages 14 to 18, we find (under 7) "Pas de pli costal," which leads us finally to 27 where we read: "un pli costal chez le ♂." . . . Genus *Coccius* G. & S." How is one to use this table? If *Coccius* has a costal fold, it should come in the section with a costal fold, where it would apparently fall next to *Plestia* Mab. Again under 33 is the second alternative "Pas de pinceau semblable" (*i. e.*, Pas de pinceau de poils couchés sur le dessus ou le dessous des ailes inférieures), which leads us to 40, where is "Un pinceau de poils couchés dans le pli abdominal . . . Genus *Pyrrhopygopsis* G. & S." The genus *Orneates* G. & S. is in the table twice, while *Murgaria* Wats., *Euschemon* MacL., *Mionectes* Mab. and *Marela* Mab. are entirely omitted therefrom.

## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF OCTOBER 4, 1904 (continued from page 52).

Mr. Leng exhibited about 200 species of beetles collected in Newfoundland by Mr. W. S. Genung in July, August and September. About half the species belonged to the family Carabidæ and among those of special interest were *Cychrus brevoorti* and *Carabus maeander*. The leaf and flower beetles, Chrysomelidæ and Coccinellidæ were represented by only a few species.

Mr. Genung, who was present as a visitor, then described his journey in Newfoundland. After spending a week in Cape Breton, he visited successively Bay St. George and Bay of Islands on the west coast; Lewisport on the east coast and Whitbourne and St. Johns in the peninsula of Avalon. A mountain range about 2,000 feet high bounds the west coast, in the ravines of which the snow does not melt; the soil is poor and the climate cool and windy even in midsummer. Throughout the railway line in the interior of the island extensive forest fires made collecting impossible. Along the east coast and especially in Avalon the conditions are more favorable for animal life and there the population principally centers. Mr. Genung spoke of the caribou which migrate annually from north to south; of the grouse and other shooting; of the fishing and general attractions of the island to sportsmen. He also mentioned the black-flies which abound in July about wet places, the sphagnum moss swamps, rivers and ponds with which the island is abundantly provided. He also described the localities in which the rarer Carabidæ were found, deep dark ravines continuously moist all the season through and spoke of the habits of these insects.

Mr. C. Schaeffer, under "Notes on a New Phasmid," remarked that in the Proceedings of the U. S. National Museum, a few months ago, Mr. A. N. Caudell published a note on the occurrence of the phasmid *Haplopus evadne* Westw. in Dry Tortugas, Florida. The specimens, one adult and one nymph, were collected by Dr. A. G. Mayer and are in the collection of the Brooklyn Museum, the adult specimen being in poor condition, lacking the last three abdominal segments and the antennæ, was considered by Mr. Caudell to be the female of *Haplopus evadne*, of which only the male was known, and gave a description of this supposed female. Very recently Dr. A. G. Mayer, now Director in charge of the Marine Biological Laboratory of the Carnegie Institute in Dry Tortugas, placed in the hands of Mr. Schaeffer a number of these phasmids preserved in alcohol. Most of the specimens were adults and represented both sexes. From an examination of this material it became evident that the supposed female described by Mr. Caudell is the male and that both sexes have aborted wings. The male *Haplopus evadne* is described as having long wings and it is possible that this phasmid is a new species. All of our Phasmidæ thus far recorded are entirely wingless and the addition of this Florida species is of great interest. There is also a nymph of this species in the collection of the Brooklyn Museum, taken last year by Mr. Gustav Beyer, at Key West, Florida. Dr. Mayer, who collected the specimens at Mr. Schaeffer's request, informed him that the phasmid occurs in bay cedar bushes.

Mr. Wm. T. Davis, under "Note on the occurrence of *Leptura cruenta*," stated that Professor Smith in his "List of New Jersey Insects" records that a dead speci-

men of *Leptura cruenta* Hald. was taken by Mr. Charles Liebeck at Da Costa, Atlantic County, New Jersey. Mr. Joutel and himself, while collecting at Hewitt, New Jersey, on the 19th of last June, were fortunate to find a specimen of this rare longicorn on the flowers of the low growing dog-wood *Cornus canadensis*. A few days previously Mr. Joutel had collected a specimen at Hastings-on-the-Hudson in New York State.

This species is not mentioned in either the Buffalo, Cincinnati or Washington Lists of Coleoptera. Mr. Leng has given its distribution as follows: Pennsylvania, Georgia, Texas, Canada and western.

Mr. Harris reported the localities he had visited in the search for Cicindelidæ. Among the places mentioned were southern Delaware, Popenoe Mts. in West Virginia, Burlington, Vt., Peekskill, N. Y., and in all of these localities results were poor in any but the more common species. He found better collecting in the Adirondack Mts. early in August, where he took eight specimens of *C. longilabris* on top of Jay Mts. From the 10th to the 21st of September he collected along the south shore of Long Island, taking many large specimens of *C. rugifrons*, one *C. consantanea*, one *C. generosa*, several *C. repanda*, sixty-three *C. purpurea*, and a number of fine specimens of *C. vulgaris*.

Discussion as to whether *C. rugifrons* occurs along beaten roads or in grass patches, participated in by Messrs. Weeks, Joutel and Schaeffer.

Mr. Bueno stated that he had collected several weeks at Westfield, N. J., and found poor results from sweeping, but water-bug collecting was good.

Mr. Joutel exhibited a peculiar egg cocoon of a spider which resembled the receptacle and calyx of a flower after the petals had fallen off.

Mr. Leng under "Remarks on *Cychrus*" stated that in his opinion many of the so-called species were not specifically different, but really represented one species occurring in different localities under different conditions. These were entitled to race names rather than specific names. He spoke of *C. elevatus* and *C. viduus* as an instance in point.

Mr. Weeks stated that contrary to report he had not observed that *Colias philodice* was being replaced in this vicinity by *Pieris rapæ*.

#### MEETING OF OCTOBER 18, 1904.

Held at the American Museum of Natural History. Vice-President C. W. Leng presided with nine members and one visitor present.

On motion of Mr. Groth, Mr. William Wood was elected an active member of the society.

The question of holding but one meeting monthly was raised and the discussion was participated in by nearly all of those present. The concensus of opinion being opposed to the suggestion.

On motion of Mr. Bueno the question was laid on the table until the first meeting in October, 1905.

Mr. Barber under the subject of "Preliminary List of Pentatomidæ collected in Brownsville, Texas, by Mr. C. Schaeffer" gave a few notes on the distribution of the species collected from that locality and exhibited the collections of thirty-one species. Of these five are new to the United States and one a new species.

Mr. Schaeffer called attention to the synonymical notes on *Exochomus margini-*

*pennis* and *Brumus septentrionis* by J. Weise and stated that if this was correct *Exochomus childreni* has also to be added as a color variation to *E. marginipennis* as he possessed a complete series from Missouri showing all of the intermediate forms from *E. childreni* to *E. marginipennis*. Mr. Schaeffer said that in his opinion there was a mistake in Weise's synonymy to which he would refer later.

Mr. Leng exhibited specimens of Coccinellidæ collected in Newfoundland and Cape Breton by Mr. W. S. Genung, also specimens collected on Mt. Katahdin, Maine, by Mr. H. G. Barber, in the White Mountains by Mrs. Annie Trumbull Slosson, and in the Adirondack Mountains by himself. Some of these species are found in all these northern localities and most of the species are not found in the vicinity of New York. The disparity between the apparently common northern species and ours seems striking and greater than prevails in other families.

Mr. Bueno exhibited some peculiar Aradidæ from Costa Rica.

#### MEETING OF NOVEMBER 1, 1904.

Held at the American Museum of Natural History. Vice-president C. W. Leng presided with ten members present.

On motion the society voted to dispense with the regular order of business and proceed at once to scientific discussion.

Mr. Barber presented a few remarks on the Genus *Cosmopepla* of the Pentatomidæ and exhibited specimens of all of the species occurring within the limits of the United States.

Mr. Watson exhibited a jar of barley infested by a little brown beetle (*Tribolium ferrugineum* Fabr.). From the same jar of barley he had previously bred a number of specimens of a micro-lepidopteron.

Mr. Southwick exhibited his collection of Cicindelidæ among which were some interesting varieties.

Mr. Davis remarked that he wished to record that he had found *Cicindela lepida* occurring quite abundantly at Machiponix, N. J., in the same neighborhood where the beach plum was growing.

Mr. Bueno exhibited specimens of *Plaa striola* and *Amorgius calosomum* to show two extremes in size among the aquatic hemiptera.

Mr. Joutel read a letter from Dr. R. E. Kunze, of Phoenix, Arizona, in which was given a detailed account of some of his summer's experiences in insect collecting.

Mr. Davis exhibited a specimen of the marshmallow and specimens of bumble bees covered with the pollen of this flower.

#### MEETING OF NOVEMBER 15, 1904.

Held at the American Museum of Natural History. Vice-President C. W. Leng presided with ten members in attendance.

On motion of Mr. Joutel the matter of printing on the back cover of the Journal, a list of the important saleable papers was referred to the librarian and treasurer.

Mr. Leng asked for a discussion of the suggestion of Dr. Dyar that the printing of the proceedings of the society be discontinued in the Journal. The question was freely discussed and unfavorably considered by all of those present.

On motion of Mr. Joutel the society voted to contribute \$25 from the society fund to the Journal fund.

Mr. Davis read a paper entitled "Notes on the Thread-legged Bug (*Emesa longipes*)."

He stated that while stopping at Sommerville, N. J., last August he and Mr. Leng had found this insect in abundance under the roof of the piazza. In the same situations were the webs of many spiders from which the *Emesa* probably obtained many captured insects. Their powers of flight seemed very limited as one disturbed individual flew only about four feet to the floor. Mr. Davis remarked that he had kept individuals alive for a period of two or three weeks, when they fed upon flies. The insect is nocturnal and during the day remains inactive. He also remarked on the odor which he said was very faint in some and in others unnoticeable. In walking, the *Emesa* does not usually use the raptorial fore legs. He exhibited several adult specimens and one egg of which he gave a description remarking that according to Uhler the egg laying habits are unknown.

Mr. Bueno, under the subject of "Notes on *Hydrometra martini* Kirk. (= *lineata* Say), gave briefly the generic and specific synonymy, and mentioned Kirkaldy's and Martini's details of same. This species was taken by Mr. Davis and himself in Staten Island in May of this and last year. Its manner of progression was touched upon, as well as its habits of lying on the surface of the water and approaching its prey, which consists of living or dead insects. He gave the period of development from the egg to the adult as 25 to 35 days, allowing for from three to five broods in the course of the summer. Just after reaching maturity the insect is covered with a grayish pruinosity. It is long-lived and tenacious of life. He also referred to Say's variety *australis*, which, from the differences it presents in the terminal abdominal segments, leads him to the belief that it is a distinct species.

Mr. C. Schaeffer presented "Some Notes on Brenthidæ." On rearranging his material in this family he found among the unmounted Texas material of the Dietz collection a Brenthid which is apparently new. The species is allied to the Mexican *Heterobrenthus distans* Shop. from which it differs in the pubescence of the outer antennal joints, the strong punctures at sides of each elytron and the different maculation. The antennæ being destitute of stiff hairs is one of the characters included in the generic description which does not fit the new species but as all other characters agree he preferred to put it in this genus. The other two species added to our list since Dr. Horn's paper, are *Vasseletia vasseleti* from Lower California and *Trachelinus uncimanus* from the Florida Keys, the latter only recently reported by Mr. Gustav Beyer in the Journal. The separation of the females of the two species of *Brenthus* have always caused some trouble, but besides the femoral teeth, the form of the second interstice is a very good character to separate the females of the two species. Mr. Schaeffer also stated that he had prepared a short synopsis of the Brenthidæ to be published in the Journal. In preparing the synoptic table of the genera he had met with considerable difficulty as the classification of the family is very unsatisfactory and based on the male characters alone, therefore the characters used will only apply to the forms occurring in the United States.

H. G. BARBER,  
Secretary.

**LIST OF ACTIVE MEMBERS OF THE NEW  
YORK AND BROOKLYN ENTOMO-  
LOGICAL SOCIETIES.\***

- Aaron, Eugene. B.  
Ahlstrand, Alfred T., No. 1103 Pacific St., Brooklyn, N. Y. Lepidoptera. B.  
Ashmead, Wm. H., D.Sc., U. S. Nat. Museum, Washington, D. C. Hymenoptera  
and Rhynchota. B.  
Barber, H. G., 241 W. 135th St., N. Y. City. Heteroptera-Hemiptera. N., B.  
Becker, Edward, 343 Central Ave., Brooklyn, N. Y. Lepidoptera. B.  
Benedict, C. P., Manor Road, West New Brighton, N. Y. General Entomology. N.  
Bennett, Howard, 37 Stewart St., Brooklyn, N. Y. B.  
Best, Lyman A., 748 Carroll St., Brooklyn, N. Y. General Entomology. B.  
Beutenmüller, Wm., American Mus. Nat. Hist., N. Y. City. Lepidoptera. N., B.  
Beyer, Gustav, 511 E. 117th St., N. Y. City. Coleoptera. N., B.  
Billings, Geo. A., College Farm, New Brunswick, N. J. N.  
Bird, Henry, Rye, N. Y. Lepidoptera. N.  
Bremser, Eugene A., 329 Riverdale Ave., Yonkers, N. Y. Lepidoptera. N., B.  
Browning, Mrs. W. H., 18 W. 54th St., N. Y. City. N.  
Brues, Charles T., Paris, Texas. Diptera and Hymenoptera. N.  
Bueno, J. R. de la Torre, 25 Broad St., N. Y. City. Rhynchota, especially Crypto-  
cerata. N.  
Call, Richard E., Ph.D., 1238 Bedford Ave., Brooklyn, N. Y., Cave Insects, Para-  
sitic Hymenoptera. N., B.  
Camman, D. M., M.D., 19 E. 33d St., N. Y. City. N.  
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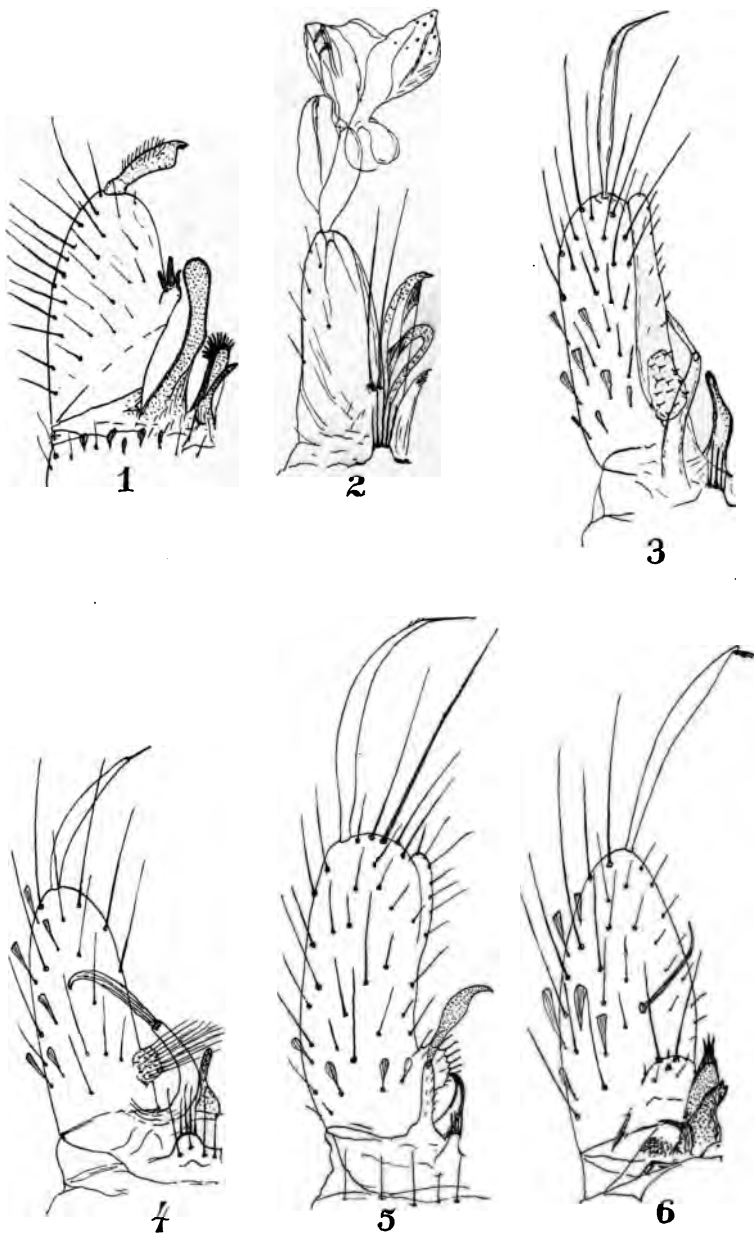
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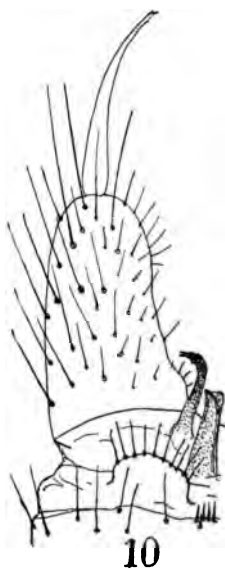
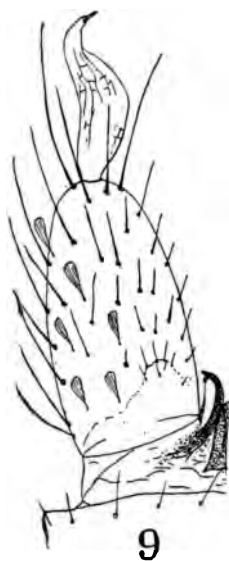
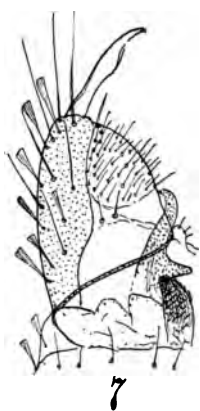
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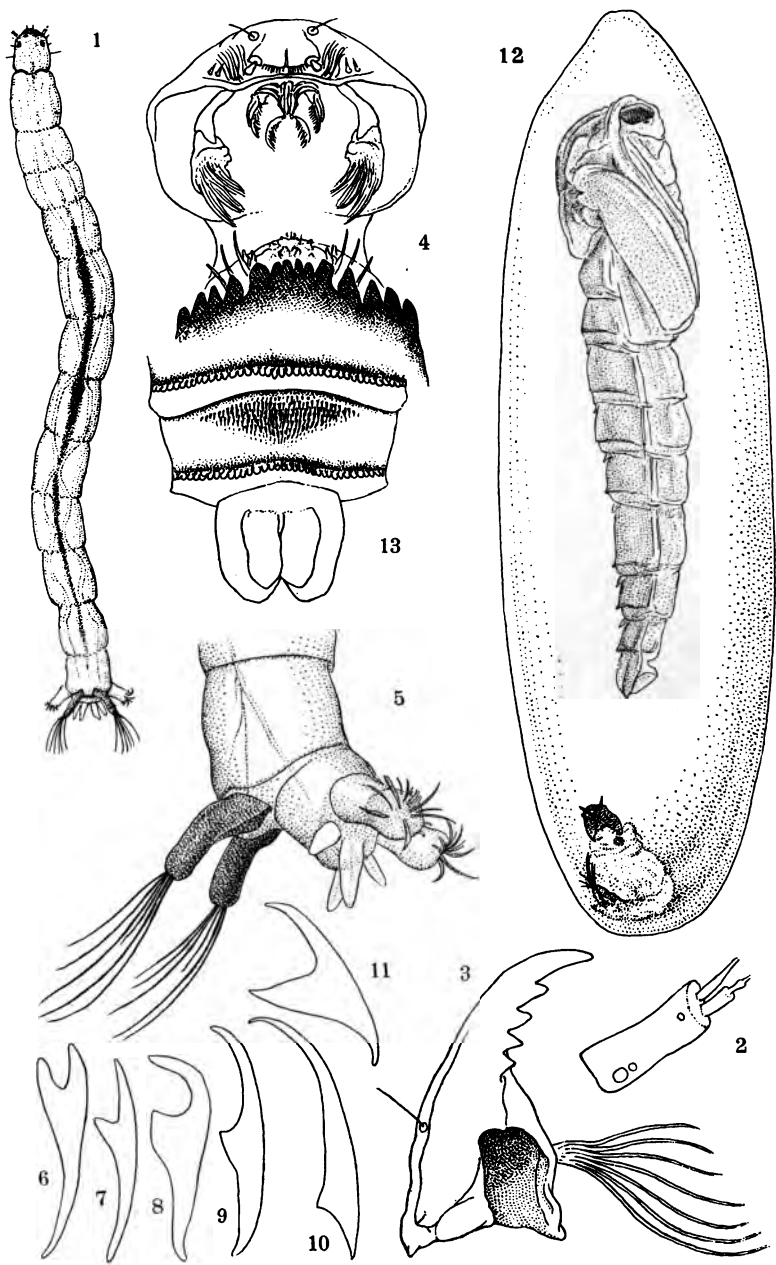
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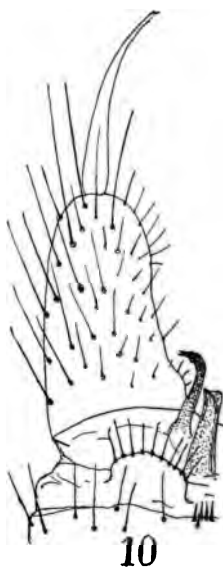
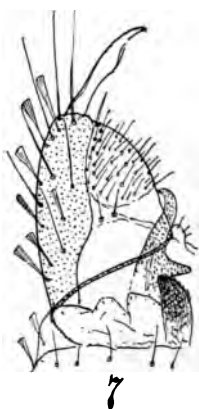




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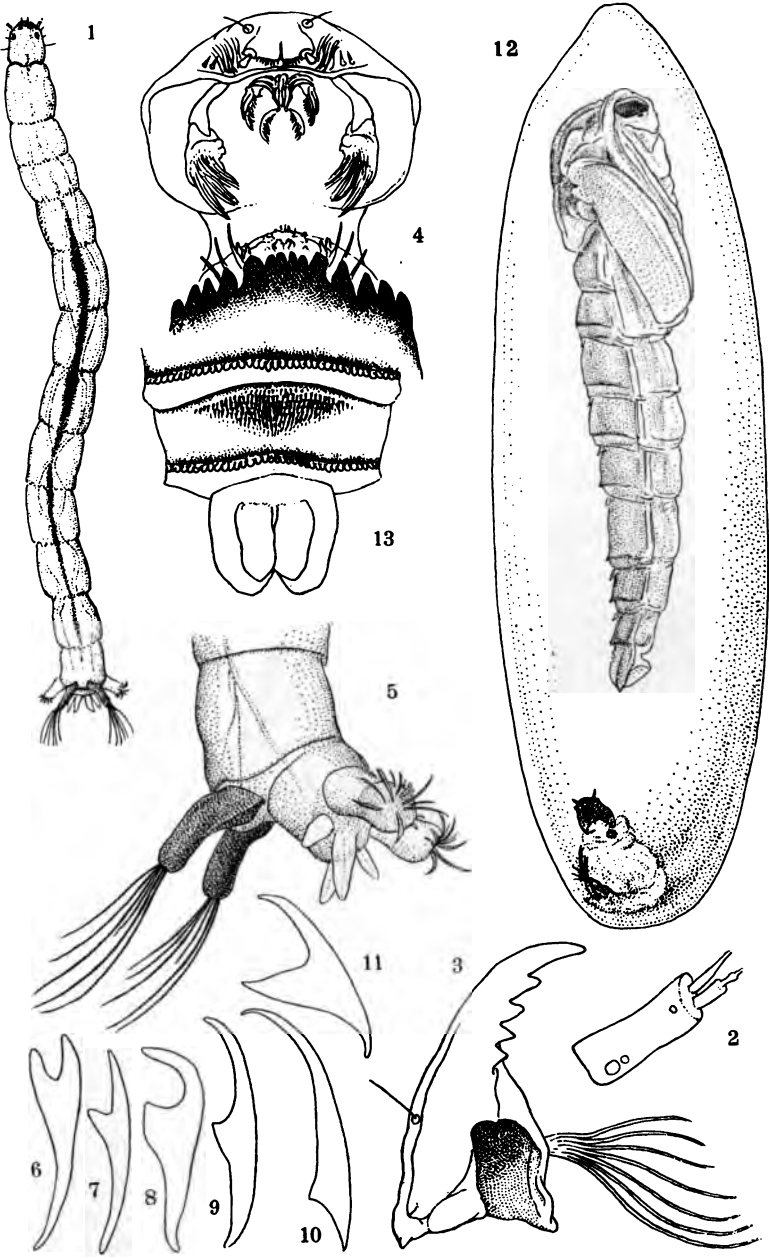
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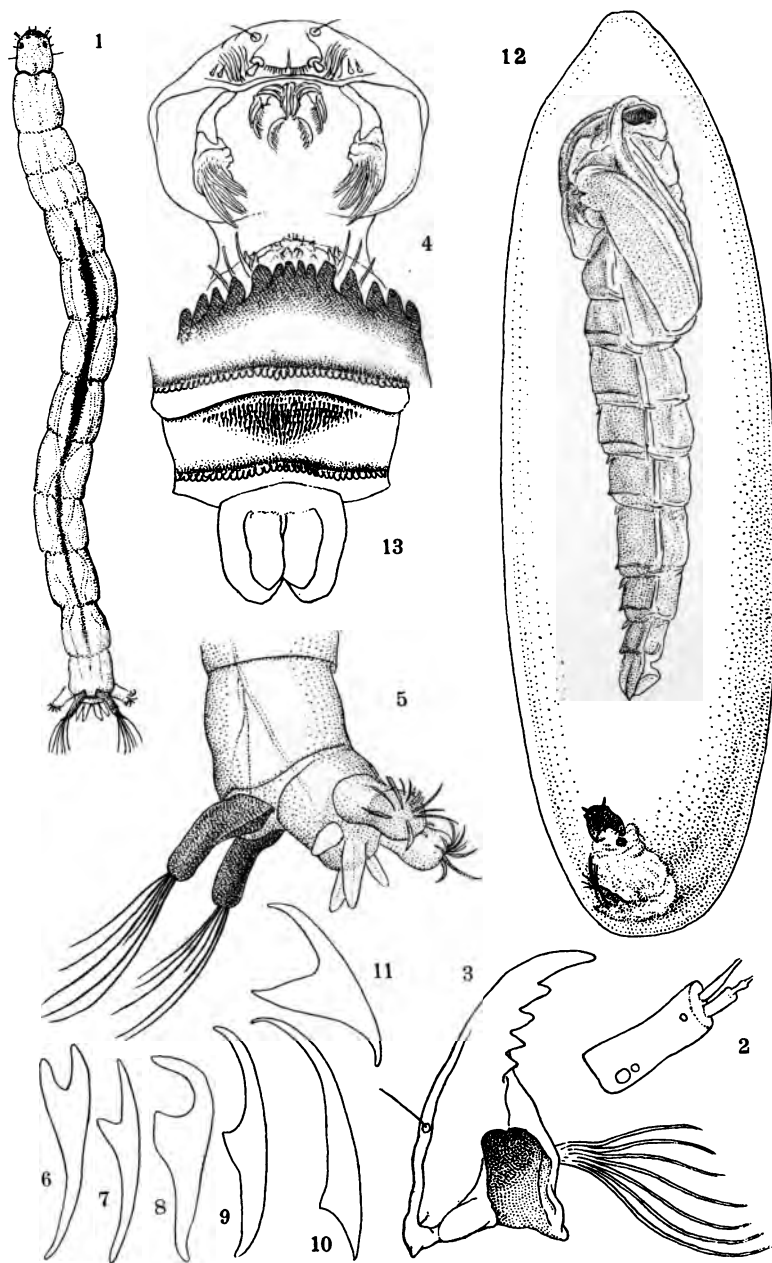
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No. 3

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Class I, HEXAPODA.

Order II, COLEOPTERA.

THE DISTINCTIVE CHARACTERS OF THE EAST-  
ERN SPECIES OF THE GENERA *DYTISCUS*  
AND *CYBISTER*.

By C. H. ROBERTS, Sc.D.,  
NEW YORK, N. Y.

All the species of the genus *Dytiscus* are of large size, the upper surface of dark color with a yellow stripe along the side of the thorax and elytra; the clypeus is yellow, and there is on the middle of the head an angular yellow mark; in addition to these yellow marks some species have the anterior and posterior margins of the thorax yellow, and the eyes margined with yellow. The color of the under surface is either pitchy black or yellow, or is intermediate between the two, or a mixture of them.

The form is comparatively little convex, always elongate, but of variable width.

The clypeus is always separated from the head by a suture visible across the whole width of the head. This entire clypeal suture, so far as has been observed, exists only in this genus and in the European genus *Meladema* in the Dytiscidæ, although it occurs in *Pelobius* and *Amphizoa*, and is common in the Carabidæ. The prothorax is destitute of a lateral margin. The prosternal process is of variable length, rather elongate and narrow, distinctly margined at the sides and is received into a groove of the metasternum.

The hind legs are but little developed for swimming being long

and rather slender. Their tibiæ are usually about three times as long as broad; the tarsi are considerably longer than the tibiæ and are terminated by two rather slender, curved, nearly equal claws. In the more perfect species, as *hybridus*, the swimming legs have become shorter and thicker and their claws more unequal.

The hind coxæ are rather small and the wings of the metasternum of moderate area; the coxal notch is elongate, and beyond it the coxal processes tend, in numerous species, to lengthen and become slender, so as to form two spinous projections in the extreme cases.

The anterior tarsi of the male are very highly developed; the three basal joints are very much dilated and form a nearly circular saucer, fringed at the edges beneath with elongate hairs, and bearing on their under surface two large palettes at the base, and elsewhere a dense pubescence—each hair bearing a minute palette at its extremity; the fourth and fifth joints are not dilated, the latter elongate.

The middle tarsi of the male have the three basal joints dilated and elongated, the three together assuming a narrow, parallel form, and are densely clothed beneath with a glandular or spongy pubescence.

In many species the females are dimorphic, one form being nearly similar to the male in sculpture, while the other bears deep elongate grooves on the elytra.

The species of *Dytiscus* inhabit the northern parts of the new and old worlds, and Persia and Japan have each one peculiar species.

The species of *Cybister* are also of large size and there are numerous species scattered over the whole world. They differ from *Dytiscus* in that the males have only a single claw on the hind tarsus; the females also usually have only one, and in certain cases a rudimentary second on the underside at the inner edge of the larger one. The prosternum is not channelled.

We have but one eastern species.

Dr. D. Sharp has separated *Dytiscus* into four groups as follows:

*Group I.*—Labrum distinctly emarginate in middle; apices of coxal processes *not* spinose. Into this group fall our species *fasciventris*, *hybridus*, *verticalis*, *marginicollis*, *sublimbatus* and *marginalis*. Of these we have in the East *fasciventris*, *hybridus*, *verticalis* and perhaps *marginalis*.

*Group II.*—Labrum distinctly emarginate in middle; apices of coxal processes acutely spinose. Into this group fall *circumcinctus*, *parvulus*, *vexatus* and *dauricus*.

Of these we have in the east *dauricus* only.

*Group III.*—Labrum truncate in middle; apices of coxal processes acutely spinose; margins of elytra dilated. America is not represented in this group, the one species being from northern Europe.

*Group IV.*—Labrum nearly truncate in middle; apices of coxal processes obtuse; margins of elytra nearly simple.

Represented by one species, *harrisii*, which is found here in the East.

Of *Cybister* we have one species here, *fimbriolatus*, easily separated from *Dytiscus* by the generic characters and by its general form, which, instead of being regularly ovate, is more or less wedge-shaped on account of its being quite rapidly narrowed from base of thorax to head, and gradually broadened from base of thorax to one third from apex of elytra.

Having eliminated *Cybister fimbriolatus*, the only eastern *Cybister*, this leaves us with six species of *Dytiscus* to differentiate, namely: *fasciventris*, *hybridus*, *verticalis*, *marginalis*, *dauricus* and *harrisii*. At a casual glance the three most likely to be confused are *verticalis*, *dauricus* and *harrisii*, as all are of large size and similar form.

We can easily distinguish *verticalis* from the other two by the absence of a yellow apical and basal thoracic margin, and we can at once separate *dauricus* from *harrisii* by the form of the coxal processes. In *harrisii* they are rounded and blunt, in *dauricus* produced into a sharp spine. There is also the group character in the shape of the clypeus—*dauricus* DISTINCTLY emarginate; *harrisii* nearly truncate or scarcely at all emarginate.

The only other species likely to be confused with these is *marginalis*, but it is smaller than the other three and the group characters will separate it, it combining half of each, but agreeing with neither. The labrum being *distinctly* emarginate distinguishes it from *harrisii* and the coxal processes being rounded, not acutely spinose, separates it from *dauricus*, thus throwing it into the first group with *verticalis*, *hybridus* and *fasciventris*.

From the other three in group I, *marginalis* can be distinguished by the yellow thoracic markings. *Fasciventris* has scarcely a trace, or none at all, of a basal or apical yellow margin, and *verticalis* has none at all; *hybridus* has a fine linear yellow line at base and a fairly distinct margin in same color at apex, while in *marginalis* the basal yellow margin is distinct all the way across and specially broad in its middle portion.

Taking up the three species left in group I, *verticalis*, *hybridus* and *fasciventris*, we can at once separate *verticalis* by its very large size and a subapical yellow line on the elytra running out as a sort of spur from the marginal band near the apical angle and continuing nearly to the suture. Neither *hybridus* nor *fasciventris* has this line.

To separate the two remaining species is very simple, both male and female having very distinct characters.

In the males of *fasciventris* the middle tarsi have the three dilated joints formed into one compact, parallel, spongy cushion, while in *hybridus* this cushion is distinctly divided longitudinally by a glabrous space.

In *fasciventris* the female has the elytra *always* sulcate while in *hybridus* they are *always*, as in the male, smooth.

There are other distinct and interesting characters by which to separate the various species, but I have tried to bring to notice those most readily observed.

The division of the dilated joints of the middle tarsi in the male of *hybridus* by a glabrous space, as mentioned, at once distinguishes it from any other species of *Dytiscus*.

We can summarize the distinctive characters as follows :

*D. fasciventris*. — Labrum distinctly emarginate ; coxal processes rounded, not produced ; basal and apical thoracic yellow markings absent, or a mere trace ; dilated joints of middle tarsi of male forming one compact, parallel, spongy cushion ; females always sulcate.

*D. hybridus*. — Labrum distinctly emarginate ; coxal processes rounded ; a fine, linear yellow line at base of thorax and a fairly distinct margin in same color at apex ; dilated joints of middle tarsi in male separated beneath longitudinally by a glabrous space. Females always smooth.

*D. verticalis*. — Labrum distinctly emarginate ; coxal processes rounded, not produced ; no trace of basal and apical yellow thoracic margins ; a yellow subapical line on the elytra starting from the marginal band and nearly attaining the suture. Females smooth.

*D. marginalis*. — Labrum distinctly emarginate ; coxal processes rounded ; thorax with a distinct apical and basal yellow margin, the basal one being broader in its middle portion. Females dimorphic.

*D. dauricus*. — Labrum distinctly emarginate ; coxal processes produced, distinctly spinose ; thorax at base, apex and sides broadly bordered with yellow. Females dimorphic.

*D. harrisii*. — Labrum nearly truncate in middle; coxal processes not produced, blunt; thorax at base, apex and sides broadly bordered with yellow. Females dimorphic.

*Cybister fimbriolatus*. — Distinguished by its wedge-like, instead of regularly oval shape and the generic characters.

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## Class I, HEXAPODA.

### Order IV, DIPTERA.

## BRIEF NOTES ON MOSQUITOES.

BY HARRISON G. DYAR, A.M., PH.D.,

WASHINGTON, D. C.

DISTRIBUTION OF *THEOBALDIA ABSOBRINUS* FELT. — In reëxamining my series of *Theobaldia incidens* from British Columbia (Pro. ent. soc. Wash., vi, 38, 1904), I find it to contain a mixture of a second species which I am able to identify with *T. absobrinus* Felt, both by the larvæ and male genitalia of the adults. This greatly extends the known distribution of this form which was described from northern New York.

IDENTITY OF *CULEX CONSOBRINUS* DESV. — We have examined material collected by Mr. August Busck in St. Louis, Missouri, which Mr. Coquillett considers to be *C. consobrinus*, and recognize it as *C. magnipennis* Felt. It is altogether probable that *magnipennis* is a synonym of *consobrinus*, as we know of but the one larval form and the male genitalia of Mr. Busck's specimens agree exactly with Dr. Felt's figure. Dr. Felt did not know *consobrinus* in describing *magnipennis*. The species will find place in the genus *Theobaldia*, or rather *Culiseta* since *Theobaldia* is preoccupied by *Theobaldius* Nevill, as Mr. Cockerell has pointed out to me.

EXCLUSION OF THE NAME "*CULEX REPTANS*." — Linnæus described a *Culex reptans*, which is not a mosquito, but, on the principle of "once a synonym, always a synonym" the use of the name is precluded in any other sense. The name "*Culex reptans* Meig." must therefore cease to be used.

HIBERNATION OF THE HOLLOW TREE SPECIES. — Of the two spe-

cies of mosquitoes whose larvæ normally live in the water in hollow trees, *Pneumaculex signifer* Coq. and *Grabhamia triseriata* Say, I have shown that the latter hibernate in the egg state. The former, it now appears, hibernate in the larval state. Mr. Busck brought a number of *P. signifer* larvæ from St. Louis in the Fall and they showed no disposition to transform. The two predaceous species of the hollow trees, *Anopheles barberi* Coq. and *Megarhinus portoricensis* von Rod. likewise hibernate as larvæ. I have observed this in the case of the *Anopheles* formerly and Mr. Busck's *Megarhinus*, brought with the *Pneumaculex*, has lived all winter in the laboratory. It would appear as if the *Pneumaculex*, must suffer more from the predaceous habits of the other species than the *Grabhamia* does, since it is longer coexistent with them in the larval state.

RELATIONSHIP OF CULEX INCONSPICUUS GROSSBECK. — The figures of fragments of the larva of this species given on page 297 of Smith's Report on Mosquitoes (1905) show it to be allied to the species described by Felt and Young as *Culex lazarensis*. However, the male genitalia of *inconspicuus* as figured differ from those of *lazarensis* as figured even to a generic degree. *Inconspicuus* falls in *Culicelsa* while *lazarensis* belongs to *Grabhamia*. This looks like a disagreement between larval and genitalic characters which is unusual, and may indicate that the genus *Culicelsa* is not well founded or that the association of larvæ and adults under *C. inconspicuus* is inaccurate (see also Proc. ent. soc. Wash., vii, 48, 1905).

GENERIC LOCATION OF CULEX DISCOLOR COQ. — I included this species among the unidentified list under the genus *Grabhamia* (Proc. ent. soc. Wash., vii, 48, 1905), but Smith's figures recently at hand show it to be referable to the genus *Feltidia*. The larva differs from the other larvæ of *Feltidia* known to us, among other things, in that the air tube is not inflated. Its characters are, as it were, curiously reversed, for it is the antennæ, on the opposite end of the larva, that are inflated.

DEINOCERITES CANCER THEOB. IN THE UNITED STATES. — In a recent brief tour of Florida by Mr. Caudell and myself, this Jamaican species was discovered at Miami. Dr. Grabham describes the larva as living in crab holes, and these were accordingly searched. At the time of our visit (March), there had been no rain for weeks and all the holes were dry, so that, except for a fortuitous circumstance, the species would have been missed. It happened that opposite Miami a canal is being

cut through the peninsula, and the salt water from the dredging operations filled three or four holes at the edge of the mangrove swamp on the Biscayne Bay side. In one of these holes several larvæ were found, which had just hatched from the influence of the water. The species must pass the dry season in the egg state.

HABITS OF *CULEX TRICHURUS* DYAR. — As already shown, this species has a northern distribution throughout North America. The larvæ are among the earliest appearing of the early Spring species. They inhabit open grassy pools, swamps and woods pools, not in large numbers, but rather generally distributed. In April, 1905 (a backward season), we found all the largest larvæ in several collections at Chicopee, Mass., and Plattsburgh, N. Y., to be of this species. The larvæ descend easily to the bottom when disturbed where they wriggle in the mud, so that deep dipping is required to collect them. They soon seek the surface however. The larvæ are light in color, rather yellowish, and can be picked out from the other inhabitants of the pools by this character and their size without a lens.

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## Class I, HEXAPODA.

### Order V, LEPIDOPTERA.

## SOUND PRODUCED BY LEPIDOPTEROUS LARVÆ.

BY HARRY FEDERLEY,

HELSINGFORS, FINLAND.

In No. 2, Vol. XII, of this Journal Professor Packard has published some observations upon sound produced by caterpillars. On Professor Packard's request for information regarding this question the editor has appended some. As I have been occupied during the last few years with the rearing of lepidopterous larvæ and have also made some observations regarding the production of sound by these creatures, I beg to herewith communicate the same.

The larva of the North American Saturnian moth *Telea polyphemus* can, in the third and fourth stages, by rubbing the powerfully constructed mandibles against each other produce a tolerably loud, tapping sound, which is audible at the distance of several meters. That here is question of a means of intimidation is not to be doubted, for

if the larva is left in peace it keeps perfectly quiet, but when the larva-cage is touched, or the larvæ are taken out, they make this peculiar tapping sound, resembling the ticking of a watch. In the fifth stage, singularly enough, the larvæ could not be made to tap, but this might possibly have been due to unfavorable climatic conditions.

The Finnish species of the genus *Drepana*, namely, *curvatula*, *lacertinaria* and *falcataria*, produce, like the *Drepana arcuata*, by rubbing the anal segment against the surface of the leaf, a peculiar scraping (rasping) sound. This sound, which is also tolerably loud, arises from the friction of two small chitinous teeth against the leaf. The chitin formations in question, which are somewhat dissimilar in the different species, are evidently rudiments of the vanished anal legs, which the adjacent hairs clearly indicate, as they occupy the same position round the chitin hooks as round the anal legs in the allied forms.

The *Dicranura* as well as the *Cerura* species make, when disturbed, a loud scraping sound by swinging the foremost part of the body from one side to the other, thereby pressing the mouth-parts against the surface of the leaf. This peculiarity seems to belong to all Notodontious caterpillars, although to none in so great a degree as to the genera named.

Finally I will again repeat what Staudinger\* relates of a species from the Amur district, *Smerinthus dissimilis* Brem., which goes to prove that not only larvæ, but also pupæ can produce sound. "The caterpillar, like the pupa of this species, makes, on being disturbed, a tolerably loud sound. Graeser calls the same whistling; that which I have heard from pupæ I might call rattling. The peculiar pupa, which is somewhat flattened on the ventral side and rough all over, has, at the extremity of the three middle segments of the body short, strong indentations and can, like the *Kentrochrysalis streckeri* Staud., move onwards with tolerable celerity."

That all the sound-productions mentioned here are a means of intimidation at the disposal of the larvæ, there can scarcely exist any doubt.

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\* Mémoires sur les Lépidoptères. N. M. Romanoff, Tome VI, 1892, p. 232, Pl. IV, fig. 3.



## A REVIEW OF THE HESPERIIDÆ OF THE UNITED STATES.

BY HARRISON G. DYAR, A.M., PH.D.,

WASHINGTON, D. C.

I have remarked on the latest general work on the Hesperiidæ (Jour. N. Y. ent. soc., xiii, 98, 1905) and pointed out that nearly half of the United States species were omitted therefrom. Our species have, therefore, yet to be correctly placed. An attempt to do this was made in Bulletin 52, U. S. National Museum, but the result is unreliable as there was no time then for special study. Dr. Holland has placed the commoner forms in the "Butterfly Book"; but his arrangement does not agree with Mabille's entirely and he has omitted many species. Scudder's system has been adopted by all the leading students of the Hesperiidæ, Watson, Godman and Salvin, Holland, Mabille; it is time that our species were correctly arranged. I have endeavored to do that in the present article and have referred all the described forms to their modern genera. Five species that I have not seen are inferred from the descriptions only, viz., *Pamphila harpalus* Edwards, *P. cabelus* Edwards, *P. yuma* Edwards, *P. milo* Edwards and *P. chusca* Edwards. For a few others not seen I have other evidence. I am indebted to Dr. Hy. Skinner for loan of some types and for permission to look over his collection; I have also looked at some specimens in the collection of the Brooklyn Institute by the kindness of Mr. Doll and in the Strecker collection by the kindness of Mrs. E. E. Strecker. My main reliance, naturally, has been the collection of the United States National Museum, including Mr. Wm. Schaus' material on deposit there.

Family HESPERIIDÆ.

Subfamily PYRRHOPYGINÆ.\*

Genus PYRRHOPYGA Hübner.

***P. arizonæ* Godman & Salvin.**

Our species has been erroneously identified as *P. araxes* Hew.; but

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\*The definitions of the subfamilies and sections are given in Mabille's work.

it differs therefrom in the smaller size, browner tint and greater diffusion of the ochreous color below.

### Subfamily HESPERIINÆ.

#### SECTION A.

##### KEY TO THE GENERA.

1. Fore wings with a costal fold..... 10.  
Fore wings without a costal fold..... 2.
2. Apex of fore wings truncate..... **Proteides**.  
Apex of fore wings not truncate..... 3.
3. Male with a tuft of hairs on hind wing above..... **Cogia**.  
Hind wing without such a tuft..... 4.
4. Palpi ascending, second joint applied to face..... 5.  
Palpi porrect..... 7.
5. Fore wings with vein 2 midway between vein 3 and base..... **Heteropia**.  
Fore wing with vein 2 arising well toward base..... 6.
6. Club of antennæ ovoid with fine point as long as the club..... **Acolastus**.  
Club gradually thickened, curved at the middle..... **Telegonus**.
7. Vein 5 of fore wings not central, near to vein 6..... **Cabares**.  
Vein 5 of fore wings central..... 8.
8. Vein 3 of fore wings over 4 times as far from base as from cross vein.  
**Rhabdoides**.  
Vein 3 of fore wings less than 4 times as far from base..... 9.
9. Third joint of palpi long, porrect; reflexed part of club not equal to the basal part..... **Phædinus**.  
Third joint of palpi short; reflexed part of club equal to the basal part.  
**Thorybes**.
10. Hind wings with a long anal prolongation..... **Eudamus**.  
Hind wings without this prolongation..... 11.
11. Lower discocellular long and strongly arcuate..... **Phocides**.  
Lower discocellular short..... 12.
12. Hind wings with a distinct anal lobe ..... 13.  
Hind wings rounded..... 14.
13. Fore wings elongate, pointed..... **Epargyreus**.  
Fore wings trigonate..... **Plestia**.
14. Club insensibly enlarged with a fine point..... 15.  
Club with the first part ovoid ending in a fine point..... **Nascus**.
15. Fore wings with the apex sharply and squarely pointed ..... **Murgaria**.  
Fore wings with the apex more rounded..... 16.
16. Outer margin of hind wings nearly straight..... **Achlarus**.  
Outer margin of the hind wings convex, rounded..... **Cocceius**.

#### Genus PHOCIDES Hübner.

##### SYNOPSIS OF SPECIES.

1. Hind wings entire; fore wings with a red spot..... **Illea**.  
Hind wings crenulated; fore wings without a red spot..... 2.

2. Fore wings with hyaline white spots.... *urania*.  
 Fore wings without spots..... *batabano*.

**P. lilea Reakirt.**

The species is reported as occurring with us. I have seen a specimen from Texas in Dr. Skinner's collection. It is apparently a visitant only.

**P. urania Westwood.**

Reported from our southern border.

**P. batabano Lefebre.**

It occurs in southern Florida, the larva feeding on the mangrove.

**Genus ACOLASTUS Scudder.**

**A. amyntas Fabricius.**

It occurs in southern Florida, the larva on *Piscidia*.

**Genus EUDAMUS Swainson.**

SYNOPSIS OF SPECIES.

- |   |                        |
|---|------------------------|
| 1. Fore wings with distinct quadrate whitish hyaline spots..... | 2.                     |
| Fore wings with very faint or no spots.....                     | <i>simplicius</i> .    |
| 2. Hind wings without any white shades below.....               | 3.                     |
| Hind wings with distinct white shades below.....                | 4.                     |
| 3. Wings with metallic green shades basally.....                | <i>proteus</i> .       |
| Wings without any metallic green shading..                      | <i>dorantes</i> .      |
| 4. White shade on hind wings below, submarginal, entire.....    | <i>alcæus</i> .        |
| This shade median, cut by two brown spots.....                  | <i>zilpa</i> .         |
| This shade a straight central fascia.....                       | <i>albofasciatus</i> . |

**E. proteus Linnæus.**

Inhabits the southern States, the larvæ on plants of the bean family.

**E. dorantes Stoll.**

Occurs in Texas, but is not widespread in our region.

**E. simplicius Stoll.**

Reported from our southern border.

**E. alcæus Hewitson.**

Reported from our southern border.

**E. zilpa Butler.**

Reported from our southern border.

**E. albofasciatus Hewitson.**

Occurs in Texas.

**Genus PLESTIA Mabille.**

**P. dorus Edwards.**

Occurs in Arizona.

**Genus PROTEIDES Hübner**

**P. idas Cramer.**

Reported from our southern border.

**Genus EPARGYREUS Hübner.**

## SYNOPSIS OF SPECIES.

1. Hind wing without silver spots below.....**zestos.**  
Hind wing with silvery spots below..... 2.
2. Silvery spot divided; fore wing with fulvous shading at base.....**exadeus.**  
Silvery spot entire; fore wing without fulvous shading at base.....**tityrus.**

**E. tityrus Fabricius.**

Common throughout most of the United States, the larva on locust and other plants of the pea family.

**E. exadeus Cramer.**

Reported from our southern border.

**E. zestos Hübner.**

Occurs in southern Florida.

**Genus NASCUS Watson.****N. hesus Westwood & Hewitson.**

Reported from our southern border.

**Genus HETEROPIA Mabille.****H. melon Godman & Salvin.**

Reported from our southern border.

**Genus ACHLARUS Scudder.****A. lycidas Abbot & Smith.**

Occurs in the Atlantic region, the larva on certain wild plants of the pea family.

**Genus RHABDOIDES Scudder.****R. cellus Boisduval & Leconte.**

Occurs in Arizona.

**Genus MURGARIA Watson.****M. albociliata Mabille.**

The species occurs in Arizona. I have it from the Patagonia Mountains, taken by Mr. Oslar. *Eudamus coyote* Skinner from Texas is a synonym. The costal fold is present in the type, though it is much narrower than in the Arizona specimens.

**Genus COGIA Butler.**

## SYNOPSIS OF SPECIES.

1. Large, the fringe of hind wings white.....**hippalus.**  
Small, the fringe not white.....**outis.**
- C. hippalus Edwards.**  
Occurs in Arizona.

**C. outis Skinner.**

Occurs in Texas.

**Genus PHÆDINUS Godman & Salvin.**

SYNOPSIS OF SPECIES.

1. Hind wings with the fringe not white.....**mysie.**  
Hind wings with the fringe white..... 2.
2. Smaller, the hind wings rounded.....**caicus.**  
Larger, the hind wings elongate.....**epigena.**

**P. mysie Dyar.**

Occurs in Arizona.

**P. caicus Herrich-Schaeffer.**

Occurs in Arizona.

**P. epigena Butler.**

Occurs in Arizona. Dr. Skinner makes this a synonym of *epigona* H.-S., but Mabille puts *epigona* in *Rhabdoides*, whereas *epigena* falls in *Phædinus*. I use the name that I feel the more sure of.

**Genus COCCEIUS Godman & Salvin.**

SYNOPSIS OF SPECIES.

1. Hind wings with the fringe white.....**drusius.**  
Hind wings with the fringe not white.....**pylades.**

**C. drusius Edwards.**

Occurs in southern Arizona.

**C. pylades Scudder.**

Occurs throughout the Northern Atlantic states, Canada and the Pacific coast. I have specimens from Ft. Smith, Mackenzie, taken by Mr. Merritt Cary. Dr. Lintner described *Eudamus electra* from Canada, which I suppose must be a synonym of this species. I have not seen the type; it cannot be found in Albany, as Dr. Felt informs me.

**Genus THORYBES Scudder.**

SYNOPSIS OF SPECIES.

1. Under side of hind wings smooth, brown, with violet reflections.....**daunus.**  
Under side rough, squamose with irrorations..... 2.
2. Larger; spottings of fore wings smaller.....**mexicana.**  
Smaller; spottings of fore wings larger.....**æmilia**

**T. daunus Cramer.**

It is generally known as *bathyllus* S. & A., and inhabits the Southern States and Mississippi Valley.

**T. mexicana Herrich-Schaeffer.**

Occurs in Colorado and Nevada.

**T. æmilla Skinner.**

Occurs in the mountains of California and Oregon. I think it is not specifically distinct from *mexicana* H.-S., but only a local race of that species.

**Genus TELEGONUS Hübner.****T. hahnelti Staudinger.**

Reported from our southern border.

**Genus CABARES Godman & Salvin.****C. potrillo Lucas.**

Reported from our southern border.

## SECTION B.

## KEY TO THE GENERA.

1. Club of the antennæ thickened at the end, which is obtuse and bare..... 2.  
Club of antennæ tapered at the end..... 5.
2. No costal fold in the male..... **Hesperopsis.**  
A costal fold present in the male..... 3.
3. A pair of long lobes covering a bare hollow at base of abdomen in male.  
**Scelothrix.**  
These lobes short or absent..... 4.
4. Hind tibiæ with a hair pencil ..... **Heliopetes.**  
Hind tibiæ without a hair pencil..... **Pyrgus.**
5. Point of club of antennæ obtuse..... 6.  
Point of club sharp..... 11.
6. Fore wings with no costal fold..... **Chiomara.**  
Fore wings with a costal fold in the male..... 7.
7. Fore wings with a sinus at anal angle; two excavations on hind wing... **Systasea.**  
Fore wings with a small sinus; hind wings crenulate..... 8.  
Fore wings entire ..... 9.
8. Hind legs of male with a hair pencil ..... **Celotes.**  
Hind legs with no hair pencil..... **Staphylus.**
9. Costal fold of the male long, over half the margin..... 10.  
Costal fold short, less than half the margin..... **Pholisora.**
10. Third joint of palpi moderate, less than twice as long as wide..... **Thanaos.**  
Third joint long, over twice as long as wide..... **Bolla.**
11. Apex of fore wing falcate ..... **Eantis.**  
Fore wings not falcate..... 12.
12. No costal fold in the male..... **Grais.**  
A costal fold present in the male..... 13.
13. Wings elongate; hind wings wavy..... **Timochares.**  
Wings trigonate; hind wings entire..... **Melanthes.**

**Genus SCELOTHRIX Rambur.**

## SYNOPSIS OF SPECIES.

1. Size larger, expanse 22-28 mm..... 2.  
Size smaller, expanse 19-24 mm..... 3.
2. Hind wings with faint white spots above.....*centaureæ*.  
Hind wings with distinct white spots above.....*cæspitalis*.
3. Fringe of wings black spotted .. *xanthus*.  
Fringe white .....*scriptura*.

**S. centaureæ Rambur.**

Inhabits the Atlantic States, though it is rare; extends into the Northwest; I have a specimen from Ft. Providence, Mackenzie (Preeble).

**S. cæspitalis Boisduval.**

Inhabits the Pacific coast from British Columbia to California.

**S. xanthus Edwards.**

Described from southern Colorado and perhaps only a small form of *centaureæ* as Mabille suggests.

**S. scriptura Boisduval.**

From Arizona, New Mexico and California.

**Genus HELIOPETES Billberg.**

## SYNOPSIS OF SPECIES.

1. Fore wings white with black apical shading ..... 2.  
Fore wings with outer black checkered border..... 3.
2. Under side of hind wings with two brown patches at right angles.....*laviana*.  
With these patches subparallel .....*macaira*.
3. Fore wings spotted with white on the median area..... 5.  
Fore wings with the median area more or less broadly white..... 4.
4. Black submarginal band of hind wings obsolete or dentate.....*ericetorum*.  
Black submarginal band broad, nearly straight .....*domicella*.
5. Hind wings with distinct markings below.....*syrictus*.  
Hind wings with the marks nearly obsolete, white.....*philetas*.

**H. laviana Hewitson.**

Reported from our southern border.

**H. macaira Reakirt.**

Reported from our southern border.

**H. ericetorum Boisduval.**

Occurs in California, both in the plains and mountains.

**H. domicella Erichson.**

Reported from our southern border.

**H. syrichtus Fabricius.**

Reported from our southern border. Mabille includes this species

in the genus *Hesperia*, section *Pyrgus*, although it directly contradicts his diagnosis. We have no species of *Hesperia* in America; all our species have the costal fold in the male. *Syrichthus* falls in *Heliopetes* on the presence of the hair pencil on the hind tibiæ.

**H. philetas Edwards.**

Described from one female from western Texas. From this type the generic position cannot be ascertained; but Dr. Barnes has given me a male from Huachuca Mts., Arizona, which he has identified as *philetas*. It resembles *syrichthus* above and has the hair pencil; below the hind wings are nearly entirely white.

**Genus PYRGUS Hübner.**

**P. montivaga Reakirt.**

Occurs throughout the United States. We have been listing two species, *montivaga* Reak. and *tessellata* Scudd., but Mabilie unites them, following Godman and Salvin.

**Genus HESPEROPSIS, new.**

Much as in *Hesperia* Fab., but the palpi long, with long, distinct, porrect, terminal joint. No costal fold in the male; no hair pencil on hind tibiæ; two pairs of spurs. Club of antennæ ovoid, gently curved, the tip blunt and bare. Wings broad with entire margins.

Type. — *Pholisora alphæus* Edwards.

**SYNOPSIS OF SPECIES.**

- |  |                 |
|--|-----------------|
| 1. Fore wings blackish with white spots.....                     | 2.              |
| Fore wings gray irrorate, black dashes in subterminal space..... | <b>alphæus.</b> |
| 2. Under side of hind wings with many white spots.....           | <b>libya.</b>   |
| Under side of hind wings with a single discal bar.....           | <b>lena.</b>    |

**H. libya Scudder.**

Occurs in southern California and Arizona.

**H. lena Edwards.**

The types were from Montana. This may be a variety of *libya* as I learn from consulting with Dr. Skinner. I have not seen any certainly determined specimens.

**H. alphæus Edwards.**

Occurs in Arizona. Mabilie places these species in *Pholisora* without comment, although they contradict his diagnosis in the absence of the costal fold and the shape of the club of the antennæ. Godman and Salvin also leave *alphæus* in *Pholisora*; but they express



doubt and mention the different shape of the club. I have thought it advisable to erect a new genus.

**Genus CHIOMARA Godman & Salvin.**

SYNOPSIS OF SPECIES.

1. Hind wings with white spots on the disk.....**asychis**.  
Wings without any white except on the fringe.....**gesta**.

**C. asychis Cramer.**

Reported from our southern border. The species looks like a *Heliopetes*.

**C. gesta Herrich-Schaeffer.**

Occurs in Texas. *Nisoniades llano* Dodge is a synonym of it as I learn from examining the type which Mr. Dodge has kindly sent to me.

**Genus EANTIS Boisduval.**

**E. thraso Hübner.**

Occurs in Texas on our southern border.

**Genus GRAIS Godman & Salvin.**

**G. stigmaticus Mabille.**

Reported from our southern border.

**Genus TIMOCHARES Godman & Salvin.**

**T. ruptifasciatus Plotz.**

Reported from our southern border.

**Genus SYSTASEA Butler.**

**S. pulverulenta Felder.**

Occurs in Texas. Dr. Skinner makes *zampa* Edw. a synonym and I follow him, although Mabille keeps these names separate.

**Genus BOLLA Mabille.**

SYNOPSIS OF SPECIES.

1. Head and palpi above golden yellow.....**ceos**.  
Head and palpi above fuscous.....**brennus**.

**B. ceos Edwards.**

Occurs in southern Arizona.

**B. brennus Godman & Salvin.**

Reported from our southern border.

**Genus CELOTES Godman & Salvin.**

**C. nessus Edwards.**

Occurs in Texas and Arizona.

Genus **PHOLISORA** Scudder.**P. catullus** Fabricius.**P. mejicanus** Reakirt.

I am unable to distinguish these forms except by the locality. Specimens from Arizona, New Mexico, southern California and Mexico I have referred to the latter; those from the rest of the United States to the former. Godman and Salvin give genitalic differences, which I have not looked for.

Genus **MELANTHUS** Mabille.**M. brunnea** Herrich-Schaeffer.

Occurs on the Florida Keys. Mabille places *Melanthus* in the section of the table that has the point of the antennal club obtuse, but it appears to me to be sharp and I have placed it accordingly. Dr. Skinner is responsible for the determination.

Genus **THANAOS** Boisduval.

## SYNOPSIS OF SPECIES.

1. Fore wings with rows of black-edged spots without hyaline centers..... 2.  
Fore wings with some of the spots white-hyaline centered..... 5.
2. Male darkly blackish, the spots not contrasting.....**somnus**.  
Male less dark, the spots more relieved..... 3.
3. Larger species.....**brizo**.  
Smaller species..... 4.
4. Bands normal, the outer one well beyond the cell.....**icelus**.  
Bands abnormal, the outer one composed of clavate rays.....**ausonius**.
5. Fringe of fore wings dark..... 6.  
Fringe of fore wings white..... 15.
6. Smaller species, the white dots mostly punctiform..... 7.  
Larger species, some of the white dots of large size..... 13.
7. Markings strongly contrasted.....**martialis**.  
Markings not well contrasted..... 8.
8. A discolorous brownish patch over end of cell.....**nævius, terentius**.  
This patch not distinct, or absent..... 9.
9. Male very dark with marks nearly obscured..... 10.  
Male less dark with the markings more contrasted..... 11.
10. Wings brownish tinted, markings legible, though obscure.....**persius**.  
Wings densely black, the markings nearly completely lost.....**pernigra**.
11. Fore wings hoary gray powdered.....**afranius**.  
Fore wings not gray powdered..... 12.
12. Smaller species.....**lucilius**.  
Larger species.....**liliius**.
13. Fore wings hoary gray powdered.....**propertius**.  
Fore wings not gray powdered..... 14.

14. Two whitish subapical spots on hind wings below.....juvenalis.  
Without these spots.....petronius, horatius.
15. Fore wings elongate, with brown discolorous patch at end of cell.....funeralis.  
Fore wings less elongate, without a patch at end of cell..... 16.
16. Smaller species with distinct markings.....pacuvius.  
Larger species with indistinct markings..... 17.
17. Hind wings below with white spots within the fringe.....clitus.  
Hind wings below without these spots.....tristis, tatus.

**T. somnus** Lintner.

Occurs in Florida. It is, perhaps, but a dark form of *brizo*; the male genitalia are the same.

**T. brizo** Boisduval & Leconte.

Occurs in the northern Atlantic and Pacific states, Washington to Athabasca. *T. callidus* Grinnell, from southern California, I was unable to formulate from the description; but Mr. Grinnell has most kindly sent me the male type, which I find to be a rather small narrowly marked *brizo* with dark ground color.

**T. icelus** Lintner.

Occurs in the Atlantic States.

**T. ausonius** Lintner.

Described from Albany, New York and never since found. It is presumably an aberration.

**T. martialis** Scudder.

Occurs in the Atlantic states.

**T. terentius** Scudder & Burgess

Occurs in the southern Atlantic states. I cannot differentiate Lintner's *navius* of Florida from this.

**T. persius** Scudder.

Occurs in the Atlantic states.

**T. pernigra** Grinnell.

Mr. Grinnell has obligingly loaned me the unique type. The species represents the eastern *persius* in California, but is separable therefrom by the very dark coloration.

**T. lucilius** Lintner.

Occurs in the Atlantic states.

**T. afranius** Lintner.

Occurs in the Rocky Mountains, Montana to Nevada.

**T. lilus** Dyar.

Occurs in the Pacific states, Washington, British Columbia, Cali-

fornia. I imagine this will prove synonymous with *tibullus* Scudd. & Burg., which I do not otherwise know. The genitalia of *lilium* are much like the figure of those of *tibullus*. In the *lilium* examined the middle lobe of the left side piece is smooth without spines; otherwise I see no essential difference.

**T. proprius Lintner.**

Occurs in the Pacific states. Specimens from Colorado formerly identified as *proprius* I now consider to be large examples of *afra-nius*. Their genitalia differ from the *proprius* of California, which proves there are two species although they are so similar.

**T. juvenalis Fabricius.**

Occurs in the Eastern states.

**T. horatius Scudder & Burgess.**

Occurs in the southern Atlantic states. I am unable to differentiate Lintner's *petronius* from Florida from this species except by the more contrasted coloration and larger spots. I do not think that they are the same, but rather that *petronius* will prove to be *juvenalis* without the white spots on the hind wings below. This character is not improbably evanescent, and is the only one I know of to separate *petronius* and *juvenalis*. *T. plautus* Scudd. & Burg., hitherto unidentified, is not improbably another synonym of *juvenalis*. The figure of the genitalia does not appear specifically different, supposing the pieces to be in a different position. The right clasp may be broken and its basal lobe somewhat uncurved. Considerable allowance has to be made in the appearance of the figures of these organs, but there is really no great variation, though their complex appearance makes them difficult to interpret at first.

**T. funeralis Scudder & Burgess.**

Occurs in the western states, Texas, Arizona, California.

**T. pacuvius Lintner.**

From Colorado and Arizona.

**T. clitus Edwards.**

From Arizona and Mexico. This seems the same as *albomarginatus* of Godman & Salvin.

**T. tristis Boisduval.**

Occurs in the western states, Southern California, Arizona, Mexico. I cannot differentiate Edwards' *tatius* from this.

The following table separates the species of *Thanaos* by the genitalia for those species that have been examined:

1. Right side piece with an outward projection at right angles ; both tips spinose.. 2.  
Right side piece without any outward projection, the lobe basal or subbasal and more or less parallel to the body of the clasp ..... 3.
2. Middle projection of left side piece longer than wide and basally curved, approximated to the clasp ..... **brizo, somnus**.  
This projection wider than long, short, truncate.....**icelus**.
3. Left side piece with no central projection ; projection of right side piece unusually basal, remote, conic.....**martialis**.  
Left side piece with a central projection ; projection of right piece less basal approximate ..... 4.
4. Basal lobe of left side piece slender, longer than wide.....**persius, lucilius**.  
This lobe broad, square, the inner angle sometimes produced..... 5.
5. Projection of right side piece very broad and truncate..... 7.  
This part moderate, band-shaped, curved toward base..... 6.
6. Middle lobe of left side piece with spiny inner angle and short outward point.  
**juvenalis**.  
This lobe with a long distinct concave outer point.....**afranius**.
7. Tip of right piece long produced, finger-shaped ..... 8.  
Tip of right piece shortly produced, truncate ..... 9.
8. Basal lobe of right side piece concave on the side.....**propertius**.  
This lobe convex on the side and roundedly curved down.....**tibullus, lilius**.
9. Basal lobe of right side piece well hollowed at the margin ; middle point of left side piece smooth.....**horatius**.  
Basal lobe of right side piece scarcely hollowed ; middle lobe of left side piece spinose ..... 10.
10. Basal lobe of right side piece slightly concave within ; tips square and joined to the side piece .....**terentius, naevius**.  
This lobe convex within with a narrow tip.....**funeralis**.  
This lobe with a double pointed tip next to the the terminal lobe.....**tristis**.

### Subfamily PAMPHILINÆ.

#### SECTION A.

#### KEY TO THE GENERA.

1. Posterior tibiz with one pair of spurs.....**Pamphila**.  
Posterior tibiz with two pairs of spurs.....**Dalla**.

#### Genus **PAMPHILA** Fabricius.

#### **P. palæmon** Pallas.

This European species occurs throughout the North from Maine to British Columbia and the mountains of California.

#### Genus **DALLA** Mabillo.

I have gathered three species from the genera *Butleria*, *Pholisora* and *Pyrgus* where they were formerly associated. Mabillo has restricted *Butleria* to Chilean species and erects a new genus, *Dalla*,

in which he puts some of Godman and Salvin's species of *Butleria*, so that I presume he intends his genus to replace *Butleria* as used by them.

#### SYNOPSIS OF SPECIES.

1. Hind wings with spots below..... 2.  
Hind wings immaculate..... *pirus*.
  2. Many small spots on hind wings below ..... *microsticta*.  
A few large spots on hind wings below..... *polingii*.
- D. *pirus* Edwards.**  
Occurs in Colorado, Utah and New Mexico.
- D. *microsticta* Godman & Salvin.**  
Reported from our southern border.
- D. *polingii* Barnes.**  
Occurs in southern Arizona.

#### SECTION B.

##### KEY TO THE GENERA.

1. Antennæ with the point of the club absent; end obtuse..... 2 -  
Antennæ with the point of the club present; end sharp ..... 6 -
2. Fore wings of male with a linear stigma..... 3 -  
Wings without a stigma ..... 5 -
3. Stigma nearly longitudinal..... *Copæodes* -  
Stigma oblique, normal ..... 4.
4. Fore wing with vein 2 nearer base than end of cell..... *Adopæa*.  
Fore wing with vein 2 at middle of cell..... *Chærephon*.
5. Fore wing with vein 12 short, the wing enlarged costally..... *Ancyloxypha*.  
Fore wing with vein 12 longer; wing normally shaped..... *Oarisma*.
6. Antennæ with the point of the club short, less than width of club..... 7.  
Point of club long, equal to or greater than the width of the club ..... 12.
7. Antennæ short, equal to the width of the thorax..... *Hylephila*.  
Antennæ longer, twice the width of the thorax..... 8.
8. Vein 3 of fore wings well before the end of the cell..... *Polites*.  
Vein 3 of fore wings near the end of the cell..... 9.
9. Male stigma with modified scales below ..... 10.  
Male stigma without modified scales below ..... *Ochlodes*.
10. Stigma apparently continuous ..... 11.  
Stigma divided by raised silky scales ..... *Catia*.
11. A large black patch below stigma..... *Atalopedes*.  
A small black area below stigma..... *Thymelicus*.  
An obscure, weak fulvous area below stigma ..... *Erynnis*.
12. Mid tibiæ with long distinct spines..... 13.  
Mid tibiæ not, or very feebly spined..... 24.
13. Fore wings of male with a stigma..... 14.  
Fore wings without a stigma..... 20.

14. Vein 2 at or beyond the middle of the cell..... 15.  
     Vein 2 arising well before the middle of the cell..... 17.
15. Male stigma thick, curved somewhat S-shaped..... **Lerema**.  
     Male stigma linear, oblique ..... 16.  
     Male stigma a broad illy defined patch. .... **Epiphyes**.
16. Third joint of palpi longer, more slender. .... **Mastor**.  
     Third joint of palpi moderate, thicker..... **Atrytonopsis**.
17. Outer margin incised above anal angle; hind wings lobed..... **Thespieus**.  
     Wings entire ..... 18
18. Male stigma double, parallel, on the veins ..... **Stomyles**.  
     Male stigma oblique, normal ..... 19.
19. Third joint of palpi long and slender..... **Amblyscirtes**.  
     Third joint of palpi short and obtuse..... **Paratrytone**.
20. Wings broad and ample..... 21.  
     Fore wings trigonate, hind wings rounded, normal..... 22.
21. Hind wings with vein 3 from the end of the cell..... **Phycanassa**.  
     Hind wings with vein 3 before the end of the cell..... **Poanes**.
22. Fore wings elongate; hind wings subcaudate..... **Calpodēs**.  
     Wings not so much produced..... 23.
23. Vein 3 of fore wings well before end of cell..... **Atrytone**.  
     Vein 3 of fore wings near end of cell..... **Lerodea**.
24. Male with a stigma..... 25.  
     Without a stigma..... 26.
25. Fore wings with vein 3 near end of cell; wings black..... **Euphyes**.  
     Vein 3 more remote from end of cell; wings fulvous spotted..... **Limochroes**.
26. Antennæ moderate, half as long as costa..... 27.  
     Antennæ long, reaching over half the costa..... **Padraona**.
27. Fore wings elongate; hind wings subcaudate..... **Prenes**.  
     Fore wings normally shaped..... **Anatrytone**.

#### Genus **ADOPÆA** Billberg.

##### SYNOPSIS OF SPECIES.

1. Hind wings below with black shades, separated by a whitish ray..... **eunus**.  
     Hind wings below nearly immaculate pale ocher yellow..... **wrightii**.

#### **A. eunus** Edwards.

Occurs on the Pacific coast. It was described from Mt. Hood; I have specimens from Los Angeles, California, and the Argus Mts. The latter have nearly lost the markings below.

#### **A. wrightii** Edwards.

I have examined four specimens in the Strecker collection from the Mojave Desert. It is not more than a local form of the preceding species.

#### Genus **CHÆREPHON** Godman & Salvin.

##### SYNOPSIS OF SPECIES.

1. Outer band on fore wings below well excurved at cell..... **rhesus**  
     This band nearly evenly arcuate..... **carus**.

**C. rhesus Edwards.**

Occurs in the mountains of Colorado and Mexico at high altitudes.

**C. carus Edwards.**

Occurs in the Huachuca and Catalina mountains of Arizona.

**Genus COPÆODES Speyer.****C. aurlantiaca Hewitson.**

Not uncommon in Texas, New Mexico and Arizona. We have been calling it by the name *procris* Edw.; but that has been shown to be a synonym.

**Genus ANCYLOXYPHA Felder.**

## SYNOPSIS OF SPECIES.

- |  |                  |
|--|------------------|
| 1. Fore wings suffused with blackish.....          | 2.               |
| Fore wings fulvous with blackish outer border..... | <b>arene.</b>    |
| 2. Fore wings with bronzy reflections.....         | <b>numitor.</b>  |
| Fore wings with bluish reflections .....           | <b>longleyi.</b> |

**A. arene Edwards.**

Occurs in southern Arizona. *C. myrtis* Edw. (Bulletin 52, U. S. Nat. Mus., no. 477) is a synonym.

**A. numitor Fabricius.**

Common throughout the eastern United States, flying in grass — near water.

**A. longleyi French.**

Described from one female taken near Chicago. I doubt its distinctness from *numitor*. Mr. Longley writes me that it was taken on the prairie away from water, but he suggests that it may have emerged from some barn where it could have been carried as pupa. If so, the unusual dryness may be the cause of the aberrant coloration of the imago. No second specimen has been met with.

**Genus OARISMA Scudder.**

## SYNOPSIS OF SPECIES.

- |  |                    |
|--|--------------------|
| 1. Fore wings bright bronzy with dark contrasted fringes ..... | <b>edwardsii.</b>  |
| Fore wings overspread with bronzy; smaller species.....        | <b>garita.</b>     |
| Fore wings broadly bronzy on the costa; larger species.....    | <b>powescheik.</b> |

**O. edwardsii Barnes.**

Occurs in Arizona and Colorado. It is hardly more than a race of *garita*, and may be the *hylax* of Edwards, as Dr. Barnes points out to me.

**O. garita Reakirt.**

Occurs in Colorado, Dakota and Manitoba.



**O. poweschek Parker.**

I have it from Wisconsin and Michigan.

**Genus HYLEPHILA Billberg.**

**H. phylæus Drury.**

Common in the Southern States to southern California and Mexico.

**Genus POLITES Scudder.**

**P. coras Cramer.**

Common in the eastern United States. Both sexes vary markedly in the amount of reduction of the fulvous markings, so that extremes might be easily thought different species. It is more familiar to us under the synonymical name *peckius* Kirby.

**Genus ATALOPEDES Scudder.**

SYNOPSIS OF SPECIES.

- 1. Female with a fulvous submarginal band and ray in cell of hind wings above. **campestris.**
- Female with one bifid yellow spot on hind wings above. **mesogramma.**

**A. campestris Boisduval.**

Occurs throughout the United States in the more southern portions; in the Mississippi Valley as far north as Dakota.

**A. mesogramma Latreille (*cunaxa* Hewitson).**

Included on the authority of Mabille, who credits the species to 'North America.' This may refer to the West Indies or Mexico. I do not know the species.

**Genus THYMELICUS Hübner.**

SYNOPSIS OF SPECIES.

- 1. Male stigma narrow, linear, straight and small. **baracoa.**  
Male stigma broader, thicker, somewhat sinuous, large 2.
- 2. Stigma nearly continuous 3.  
Stigma partly divided, showing an upper and lower black spot and an outward oblique black bar. 6.
- 3. Hind wings below grayish straw color with faint outer row of pale spots. **alcina.**  
Hind wings below brownish with an outer row of yellow spots and one in cell. 4.
- 4. Spots on hind wings below larger, diffused, nearer margin **mystic.**  
Spots below smaller, concrete, further from the margin. 5.
- 5. Fore wings scarcely washed with fulvous beyond the stigma. **siris.**  
Fore wings distinctly washed with fulvous beyond the stigma. **sylvanoides.**
- 6. Hind wings predominantly light colored below with dark markings. 7.  
Hind wings dark colored below, immaculate or with light markings. 8.
- 7. Marginal band of fore wings of male broad, heavy **vibex.**  
Marginal band narrow, dentate. **brettus.**  
Marginal band still narrower, broken opposite cell. **chusca.**

8. Hind wings immaculate below.....**cernes**.  
 Hind wings with light markings below..... 9.  
 9. Veins of hind wings below dark, separating the spots..... 10.  
 Veins pale, uniting and producing the spots.....**sabuleti**.  
 10. Marks on hind wings below distinct.....**draco**.  
 Marks on hind wings below faint and clouded.....**mardon**.

**T. baracoa Lucas.**

It is found in Florida.

**T. alcina Skinner.**

From Colorado. Dr. Skinner thinks that this may be *rhena* Edw., but we have not seen the type.

**T. mystic Scudder.**

Occurs in the eastern United States.

**T. sylvanoides Boisduval.**

Occurs on the Pacific coast and mountains.

**T. siris Edwards.**

Occurs in the western United States, Rocky Mountains to the Pacific coast. I doubt the distinctness of this form from *sylvanoides*. Both sexes are a little darker, but I see no other difference.

**T. vibex Hübner** (*stigma* Skinner, not Staudinger).

Occurs on our southern border.

**T. brettus Boisduval & Leconte.**

Inhabits the Southern States. I think this is only a varietal form of *vibex*. The dark markings in the male are more extended in *vibex*, but they vary. I have specimens from Jalapa, Mexico, labelled *vibex* by Mr. Schaus, which are indistinguishable from Texan *brettus*. Godman and Salvin also are of my opinion (Biol. Cent. Am., Rhop., ii, 480, 1900).

**T. chusca Edwards.**

Described from one male from Arizona. I have not seen the species.

**T. cernes Boisduval & Leconte.**

Inhabits the eastern United States.

**T. draco Edwards.**

From the mountains in the West; southern Colorado, Idaho, Wyoming, Crater Lake, Oregon.

**T. mardon Edwards.**

Washington (Neumoegen collection, Brooklyn Museum).

**T. sabuleti Boisduval.**

From the western United States, California, Nevada, Arizona.

Genus **CATIA** Godman & Salvin.**C. druryi** Latreille.

Better known as *otho* A. & S. ; inhabits the eastern United States. It is easily recognized by the peculiar stigma of the male which is a further modification of the *Tymelicus* pattern.

Genus **ERYNNIS** Schrank.

## SYNOPSIS OF SPECIES.

1. Hind wings below with spots united into a band forming pale rays on veins.. 2.  
These spots divided by dark veins or absent..... 4.
2. Band below white..... 3.  
Band below fulvous..... **manitoboides**.
3. Ground color of hind wings below uniformly dark brown..... **metea**.  
Ground color varied with greenish and yellow..... **unkas**.  
Ground color entirely greenish yellow..... **lasus**.
4. Hind wings with white spots below ..... 5.  
Hind wings with the spots not white, yellow, pale or obsolete..... 7.
5. A linear white ray in the cell..... **morrisoni**.  
At most a white spot in the cell ..... 6.
6. Male stigma thick, straight, partly doubled..... **comma**.  
Male stigma long, linear, curved.. ..... **juba**.
7. Hind wings with pale spots below ..... 8.  
Hind wings immaculate ..... 9.
8. Fore wings with the fulvous color reduced, absent from the costal edge.. **attalus**.  
Fore wings with the fulvous color extended, covering costal edge..... **leonardus**.  
Fore wings broadly fulvous, the outer margin broadly pale fuscous.  
**ruricola, cabelus**.
9. Stigma as usual, thick, subdivided on vein 2..... 10.  
Stigma narrowly linear, continued over vein 2..... 11.
10. Fore wings fulvous with outer fuscous edge..... **pawnee, oregoni**.  
Fore wings largely fuscous, the fulvous reduced to spots..... **meskei**.
11. Fore wings with a broad dark fuscous edge.. ..... **licinus**.  
Fore wings fulvous with a faint marginal cloud..... **ottoe**.  
Fore wings ochre yellow, immaculate..... **yuma**.

**E. morrisonii** Edwards.

I have a male from Colorado (Neumoegen, Meske collection).

**E. comma** Linnæus.

The species occurs throughout the northern and mountainous parts of the United States and has received many names. In Bulletin 52, U. S. Nat. Mus., eleven varieties are recognized, but I think three or four names will suffice. *Laurentina* Lyman, *colorado* Scudder = *manitoba* Scudder = *nevada* Scudder, *columbia* Scudder, *idaho* Edwards = *assiniboia* Lyman will be referred to the synonymy of *comma*. The varieties are distinguished about as follows :

Hind wings below dark brown, spots moderate.....	laurentina.
Hind wings below gray green, spots often reduced.....	colorado.
Hind wings below grayish green, the spots often small and tending to form a straight row; smaller than the other forms.....	columbia.
Hind wings below light yellow or greenish.....	idaho.

**E. juba Scudder.**

From Colorado, Idaho and the mountains of California. Similar to *comma* but larger, brighter fulvous with somewhat more pointed wings, the male stigma narrower and curved. The variety *viridis* Edwards has the wings more obscured with fuscous.

**E. metea Scudder.**

From the northern Atlantic States and Allegheny mountains.

**E. unkas Edwards.**

From the Rocky Mountain region, Kansas and Colorado.

**E. lasus Edwards.**

From southwest Arizona. The male type is in the Neumoegen collection in the Brooklyn Museum.

**E. manitoboides Fletcher.**

I have Dr. Fletcher's type from Nepigon. I cannot agree with Dr. Skinner that this is a form of *comma*. In the male type the pale lines on the veins below are in evidence as in *metea* and *unkas*; they are lost in the female type, which would fall in the neighborhood of *attalus* and *leonardus*, from which the coloration of the upper side separates it.

**E. attalus Edwards.**

From the Southern States; common in Florida.

**E. leonardus Harris.**

From the northern Atlantic States. This is, perhaps, only a form of the preceding.

**E. pawnee Dodge.**

From the western plains, Utah, Nebraska.

**E. oregona Edwards.**

From California and Nevada. I have not seen it. From the description it falls near *pawnee*, if it really belongs to the genus *Erynnis*. Edwards says: "Size of *colorado*; bright yellow fulvous on upper side, the subapical spots not well defined. Below grayish yellow, spots scarcely lighter (not white nor even light), the band on the hind wings slight, often maculate."

**E. meskei Edwards.**

From Indian River, Florida (Neumoegen collection, Brooklyn Museum).

**E. licinus Edwards.**

I have a single specimen from Texas which Dr. Skinner has determined.

**E. cabelus Edwards.**

Unknown to me. Described as near *ottoe*, but with pale spots on the hind wings below, lacking, however, in one specimen. Nevada.

**E. ruricola Boisduval.**

Described from California. I do not know this species. Boisduval's description as supplemented by Edwards makes the species fall near *cabelus*. Mr. Schaus, however, identifies as *ruricola* a specimen of *comma* in which the white spots are very small and nearly obsolete.

**E. ottoe Edwards.**

I have seen two males and two females in the Strecker collection from Utah. The marginal band is nearly obsolete, yet serves to define the pale spots.

**E. yuma Edwards.**

Unknown to me and perhaps in the wrong genus. From the description it must be a very distinct form. Arizona.

**E. axius Plotz.**

This is added by Mabille. I do not know it.

**Genus OCHLODES Scudder.**

SYNOPSIS OF SPECIES.

1. Large; wings brown with hyaline spots.....*snowi*.  
Smaller; wings largely marked with fulvous..... 2.
2. Stigma of male very oblique, touching vein 1 within basal third  
*harpalus, sassacus.*  
Stigma less oblique, touching vein 1 beyond basal third..... 3.
3. Hind wings dark below with contrasting yellow spots.....*pratincola*.  
Hind wings pale below, spots not contrasting..... 4.  
Hind wings immaculate below..... 5.
4. Smaller, dark markings of fore wings confluent.....*nemorum*.  
Larger, dark markings of fore wing separated into a border and a discal mark.  
*agricola, napa.*
5. Fore wings with fuscous spot at end of stigma, no translucent spots on costal margin.....*verus*.  
Fore wings without fuscous spot at end of stigma and with three translucent spots on costal margin .....*milo*.

**O. snowi Edwards.**

From Colorado and Arizona. This species is aberrant in this genus as there is a very distinct point to the antennal club, almost as long as the width of the club. It might find place near *Amblyscirtes*, but, as it would form a new generic type there, I leave it where Mabille puts it.

**O. sassacus Harris.**

From the northeastern United States.

**O. harpalus Edwards.**

Unknown to me. Described as near *sassacus* and, from the description, indistinguishable therefrom. Nevada.

**O. pratincta Boisduval.**

Inhabits the Pacific coast to British Columbia.

**O. nemorum Boisduval.**

From California.

**O. verus Edwards.**

From California; it is like *agricola* above but lacks the spots below. It is probably only a light variety of *agricola*.

**O. agricola Boisduval.**

From the Pacific Coast, British Columbia, Nevada.

**O. napa Edwards.**

From Colorado and Washington. I do not believe that this is specifically distinct from *agricola*. It is a little larger only and the markings a very little better defined. Otherwise I see no differences whatever.

**O. milo Edwards.**

Autoptically unknown to me and perhaps not of this genus, but described as near *agricola*. From Mt. Hood, Oregon.

**Genus EPIPHYES, new.**

Antennal club cylindrical, the point rather obtuse and about equal to the diameter of the club. Palpi with the third joint moderate, rather slender; wings normal, vein 2 arising at the middle of the cell, 3 before the end. Mid tibiae spiny. Male stigma a large, ill defined blotch.

Type *Pamphila carolina* Skinner.

**E. carolina Skinner.**

From North Carolina.

Genus **LEREMA** Scudder.**L. accius** Abbot & Smith.

Inhabits the Southern States. Dr. Skinner thinks that *horus* Edw. from Texas is probably a synonym.

Genus **MASTOR** Godman & Salvin.

## SYNOPSIS OF SPECIES.

1. Head and collar golden, fringe sordid pale.....**phylace**.  
Head, collar and fringe golden.....**bellus**.

**M. bellus** Edwards.

From Arizona.

**M. phylace** Edwards.

New Mexico. I have seen two specimens in the Strecker collection.

Genus **ATRYTONOPSIS** Godman & Salvin.

## SYNOPSIS OF SPECIES.

1. Hind wings immaculate above..... 2.  
Hind wings with fulvous or hyaline spots..... 5.
2. Larger species, fringe of hind wings white..... 3.  
Smaller species, fringe of hind wings not white .....**hianna**.
3. No hyaline spot at the end of the cell of fore wings.....**deva**.  
A hyaline spot at the end of the cell..... 4.
4. Brown, the discal spot lunate.....**lunus**.  
Grayer, the discal spot more erect.....**vierecki**.
5. Hind wings with a straight row of whitish hyaline spots .....**pittacus**.  
Hind wings with an irregular row of spots, accompanied by others below..... 6.
6. Spots yellow hyaline; stigma faint, straight..... **python**.  
Spots white hyaline; stigma bent, oblique, distinct.....**cestus**.

**A. deva** Edwards.

From Arizona.

**A. lunus** Edwards.

From Arizona. I have seen none but females of this species but suppose it properly referred here.

**A. vierecki** Skinner.

From New Mexico. I have examined the types in the collection of the Academy of Nat. Sci. at Philadelphia. The species looks like a faded *lunus*, but the color is evidently natural.

**A. hianna** Scudder.

Occurs in the northern Atlantic States.

**A. pittacus** Edwards.

From Arizona.

**A. python Edwards.**

From Arizona.

**A. cestus Edwards.**

From Arizona.

**Genus THESPIEUS Godman & Salvin.**

**T. macareus Herrich-Schaeffer.**

Reported from our southern border.

**Genus STOMYLES Scudder.**

SYNOPSIS OF SPECIES.

1. Hind wings below with spots joined by the pale veins.....**textor**.  
Hind wings below with pale spots on a dark ground..... 2.  
Hind wings below immaculate.....**fusca**.
2. Spots of fore wings dislocated, the 4th of the row below the cell well beyond the subapical row..... 3.  
Spots of fore wing in a curved row..... 4.
3. Larger species, expanse 25 mm.....**comus**.  
Smaller species, expanse 20 mm.....**hegon**.
4. Hind wings below with base and margin grayish, middle field brown with diffuse pale spots.....**arabus**.  
Ground color of hind wings below uniform..... 5.
5. Hind wings below brown, grayish irrorate.....**celia**.  
Hind wings below brown, yellow bronzy .....**nereus**.

**S. textor Hübner.**

Occurs in the Southern States, North Carolina, Florida.

**S. celia Skinner.**

From Texas. The male stigma consists of a slight thickening along the outer section of the median vein and base of vein 2. In another specimen it extends out a little between the fork of these veins, suggesting the form shown by *ænus* and *simius*. The species therefore approaches the genus *Amblyscirtes*.

**S. nereus Edwards.**

I have only a single worn female from the Huachuca Mountains, Arizona, named by Dr. Barnes, so I cannot vouch for the generic position in the absence of a male.

**S. hegon Scudder.**

One male is before me from Texas, labelled *samoset* by Mr. Belfrage.

**S. comus Edwards.**

Unknown to me. I see nothing in the description to separate this from *hegon* except the larger size. From Texas.



**S. arabus Edwards.**

Arizona. One specimen in the Strecker collection. It much resembles the South American *odilia* Berg.

**S. fusca Grote & Robinson.**

From the Southern States, New York to Georgia. The male stigma is practically obsolete, though I think I see a trace of it. The species might be placed in *Lerodea*.

**Genus AMBLYSCIRTES Scudder.**

## SYNOPSIS OF SPECIES.

- |   |                      |
|---|----------------------|
| 1. Hind wings with small white spots below in a circle.....                   | 2.                   |
| Hind wings not so marked.....   | 3.                   |
| 2. Larger species; third joint of palpi smaller.....                          | <b>nanno.</b>        |
| Smaller species; third joint of palpi longer.....                             | <b>elissa.</b>       |
| 3. Hind wings without white spots above, at most an obscure fulvous band..... | 4.                   |
| Hind wings with white spots above.....  | <b>eos.</b>          |
| 4. Wings black with white costo-apical dots.....                              | 5.                   |
| Wings more or less bronzy, spots fulvous or obsolete.....                     | 7.                   |
| 5. Hind wings below whitish and purple irrorate, without band.....            | 6.                   |
| With an irregularly mottled dark central band.....                            | <b>nysa.</b>         |
| 6. Marks below purplish, forming a distinct outer border.....                 | <b>vialis.</b>       |
| With pale irrorations on a dark ground only.....                              | <b>meridionalis.</b> |
| 7. Marks on wings above nearly obsolete.....                                  | <b>oslari.</b>       |
| Marks on wings above forming distinct fulvous spots.....                      | 8.                   |
| 8. Band of spots broken, no spot in the interspace 5-7.....                   | <b>ænus.</b>         |
| Band of spots continued around cell.....                                      | 9.                   |
| 9. Male stigma small, nearly obsolete.....                                    | <b>simius.</b>       |
| Male stigma large, well developed.....  | <b>cassus.</b>       |

**A. nanno Edwards.**

From Arizona.

**A. elissa Godman & Salvin.**

Reported from our southern border.

**A. vialis Edwards.**

Inhabits the northern United States, New York, Pennsylvania, Washington, British Columbia.

**A. meridionalis, new species.**

Like *vialis* above, but the spots whiter and smaller. On under side of hind wings there is only a faint purplish irroration on a brown ground, faintly showing a discal dot and outer band in pale scales. Described from three specimens in the Strecker collection from Georgia and Florida, labelled *Amblyscirtes eos*. It may be a southern form of *vialis*. The three specimens are uniform.

**A. nysa Edwards.**

From Texas and Arizona.

**A. eos Edwards.**

From Arizona.

**A. ænus Edwards.**

From Colorado and Arizona.

**A. oslari Skinner.**

Dr. Skinner has loaned me his male type from Colorado. I have a male like it from Arizona that has stood under the label *ænus* for years. Also a pair recently received from the Huachuca Mountains, Arizona, collected August 20, 1903, by Mr. E. J. Oslar.

**A. simius Edwards.**

Colorado. I have examined two specimens in the Strecker collection.

**A. cassus Edwards.**

From Arizona.

**Genus PARATRYTONE, new.**

Antennæ with the club slender, the point bent, tapered, longer than the width of the club. Palpi with the third joint short, thick; middle tibiæ spined. Vein 2 arising before the middle of the cell; male with a narrow, straight stigma from vein 3 to vein 1, broken on vein 2.

Type. — *Pamphila howardi* Skinner.

**SYNOPSIS OF SPECIES.**

1. Male stigma heavy, black; dark border of fore wings faint.....*scudderi*.
- Male stigma delicate, grayish; dark border of fore wings distinct..... 2.
2. Larger; black marks heavier, spot beyond cell touching the discal arc.....*howardi*.
- Smaller; black marks less defined, the spot beyond the cell not touching the discal arc.....*aaroni*.

**P. scudderi Skinner.**

Dr. Skinner has kindly loaned me his male and female types. He has associated the species with the *comma* group (genus *Erynnis*) but this is negated by the long point of the antennæ which is full as long as the width of the club. The types are from the White River, Colorado.

**P. howardi Skinner.**

From Florida.

**P. aaroni Skinner.**

From New Jersey. This will probably prove to be not speci-

cally distinct from *howardi* when we have specimens from the other southern states.

Genus **POANES** Scudder.

**P. massasoit** Scudder.

From the Atlantic states.

Genus **PHYCANASSA** Scudder.

**P. viator** Edwards.

From the Atlantic states, common southward.

Genus **CALPODES** Hübner.

**C. ethlius** Cramer.

From Florida and Texas, the larva on *Canna*.

Genus **ATRYTONE** Scudder.

SYNOPSIS OF SPECIES.

- |  |                 |
|--|-----------------|
| 1. Fore wings of the male with the disk broadly fulvous.....       | 2.              |
| Fore wings of the male with the disk brown with fulvous spots..... | <b>melane.</b>  |
| 2. Hind wings below brown with a large yellow patch.....           | <b>hobomok.</b> |
| Hind wings below yellow with a subbasal brown band.....            | 3.              |
| 3. Smaller; the band below usually continuous.....                 | <b>zabulon.</b> |
| Larger; the band below broken into spots or obsolete.....          | <b>taxiles</b>  |

**A. melane** Edwards.

From southern California.

**A. hobomok** Harris.

Inhabits the Atlantic states.

**A. zabulon** Boisduval & Leconte.

Inhabits the Atlantic states.

**A. taxiles** Edwards.

Inhabits the western United States.

Genus **LERODEA** Scudder.

I am unable to separate the genus *Oligoria* Scudder from *Lerodea*, and I, therefore, unite them.

SYNOPSIS OF SPECIES.

- |  |                  |
|--|------------------|
| 1. Hind wings with distinct white spots below.....               | 2.               |
| Hind wings without white spots below.....                        | 3.               |
| 2. Spots in a median row only.....                               | <b>maculata.</b> |
| Spots in a median angled row and subbasal ones also.....         | <b>loammi.</b>   |
| 3. Hind wings below brownish with traces of outer pale band..... | <b>eufala.</b>   |
| Hind wings below cinereous, longitudinally streaked.....         | <b>esyka</b>     |

**L. loammi** Whitney.

From Florida. Three specimens in the Strecker collection.

**L. maculata** Edwards.

From Florida.

**L. eufala** Edwards.

From Florida. Mabilie refers his *florida* (Bull. 52, U. S. Nat. Mus., no. 470), as a synonym of this.

**L. osyka** Edwards.

From Texas and Mexico (Oxaca, L. O. Howard).

**Genus EUPHYES** Scudder.

SYNOPSIS OF SPECIES.

- |   |                    |
|---|--------------------|
| 1. Fore wings of male with hyaline white spots..... | <b>verna</b> .     |
| Fore wings of male black, immaculate.....           | <b>metacomet</b> . |

**E. verna** Edwards.

From the eastern United States.

**E. metacomet** Harris.

From the eastern United States.

**Genus LIMOCHROES** Scudder.

SYNOPSIS OF SPECIES.

- |  |                     |
|--|---------------------|
| 1. Hind wings immaculate below.....  | 2.                  |
| Hind wings with pale spots below.....  | 6.                  |
| Hind wings dark below, veins pale, a fulvous ray above angle.....                        | <b>streckeri</b> .  |
| 2. Fore wings dark above, scarcely fulvous washed.....                                   | 3.                  |
| Fore wings with distinct fulvous discal area.....  | 4.                  |
| 3. Smaller; black border of fore wings reaching over half way to stigma.                 |                     |
|  | <b>bimaculata</b> . |
| Larger; black border scarcely reaching half way to stigma.....                           | <b>arpa</b> .       |
| 4. Stigma thick, heavy, scarcely divided.....  | 5.                  |
| Stigma narrower, more obviously divided.....   | <b>byssus</b> .     |
| 5. Fore wings with the cell to costa fulvous.....  | <b>palatka</b> .    |
| Fore wings with the costa washed with fuscous.....                                       | <b>dion</b> .       |
| 6. Stigma joined to the margin by fuscous; hind wings with little or no fulvous          |                     |
|  | <b>manataaqua</b> . |
| Stigma separated from the marginal band by fulvous; hind wings with a fulvous patch..... | 7.                  |
| 7. Yellow discal spot of hind wings separated from base by fuscous.....                  | <b>pontiac</b> .    |
| Yellow discal spot nearly reaching base over cell.....                                   | <b>yehl</b> .       |

**L. bimaculata** Grote & Robinson.

From the Atlantic States.

- L. arpa* Boisduval & Leconte.  
From Florida.
- L. byssus* Edwards.  
From Florida.
- L. palatka* Edwards.  
From Florida.
- L. dion* Edwards.  
From the eastern United States.
- L. manataqua* Scudder.  
From the eastern United States.
- L. pontiac* Edwards.  
From the eastern United States.
- L. yehl* Skinner.  
From Tennessee.
- L. streckeri* Skinner.

The single type from Florida is in the Strecker collection. The antennæ are broken and both middle legs lost, so that its true generic position is open to question. I place it provisionally in *Limochroes*; it may be found referable to *Paratrytone*.

#### Genus PRENES Scudder.

##### SYNOPSIS OF SPECIES.

1. Large species, no yellow lining on the veins of hind wings below.....2.  
Smaller species with more or less distinct yellow lining.....3.
  2. Hind wings immaculate below.....ocola.  
With a row of small bluish white spots on costal half.....nero.  
With an outer and basal pale band, a black spot below costal vein.....ares.
  3. Hind wings below with two large white dashes.....panoquin.  
Hind wings with three little white dots between the veins.....panoquinoides.  
Hind wings below with obscure yellowish dots; veins distinctly lined .....errans.
- P. ocola* Edwards.  
From Florida.
- P. nero* Fabricius.  
Reported from our southern border.
- P. ares* Felder.  
Reported from our southern border.
- P. panoquin* Scudder.  
From the southern Atlantic States.

*P. panoquinoides* Skinner.

From the Florida Keys.

*P. errans* Skinner.

From southern California.

Genus **ANATRYTONE**, new.

Club of antennæ cylindrical, the tip about as long as the width of the club, rather obtusely pointed. Wings normal, vein 2 arising near the middle of the cell, 3 close to the end. No sex mark in the male. Third joint of the palpi moderate, obtuse. Mid tibiæ without spines or a very few minute ones.

Type. — *Pamphila delaware* Edwards.

Godman and Salvin place this species in *Atrytone*; but the nearly complete absence of the spines on the middle tibiæ has induced me to remove it therefrom.

SYNOPSIS OF SPECIES.

1. Fore wing of male more or less black lined on the veins.....2.  
Fore wing without black lining on the veins.....3.
2. No black patch beyond cell.....*delaware*.  
With a blackish patch beyond the cell.....*vitellius*.
3. Wings broadly black bordered.....*arogos*.  
Wings very narrowly black bordered.....*lagus*.

**A. delaware** Edwards.

Southern States, Nebraska.

**A. vitellius** Fabricius.

I do not know whether we have this species. Dr. Skinner unites it with *delaware*, but Godman & Salvin point out differences.

**A. arogos** Boisduval & Leconte.

From the Southern States, Florida, Kansas.

**A. lagus** Edwards.

From Texas.

Genus **PADRAONA** Moore.

**P. dara** Kollar.

The species has been recorded from West Virginia, Colorado and California, but it is not certain that it really occurs with us; Dr. Holland argues that the records may be erroneous (Journ. N. Y. ent. soc., vi, 57, 1898). The genus occurs in America, as Mabilie records two species from South America; but it will be a unique record if an Asiatic species, not known in Europe, proves to be widely scattered over North America.

Subfamily MEGATHYMINÆ.

Genus **MEGATHYMUS** Scudder.

SYNOPSIS OF SPECIES.

1. Hind wings with the outer margin yellow.....2.  
Hind wings with the outer margin black.....4.
2. A white angled patch on subcostal vein below; male without erect hairs...*yuccæ*.  
No such white patch below; male with long erect hairs on the hind wings.....3.
3. Males with the hairs long; females with the dislocated spots of veins 4-6 large  
*streckeri*.  
Males with the hairs shorter; females with these spots small.....*cofaqui*.
4. With yellow spots on the hind wings above.....5.  
Without such spots.....*ursus*.
5. Fore wings with submarginal fulvous band.....*neumoegeni*.  
Fore wings with the band cut into spots by black veins.....*aryxna*.

**M. yuccæ** Boisduval & Leconte

Southern Atlantic states, the larva in the roots of *Yucca*. Mabille thinks that *coloradensis* Riley is a distinct species, but I am unable to separate it except by the size.

**M. cofaqui** Strecker.

From Texas.

**M. streckeri** Skinner.

Texas, Colorado. Not well separated from the preceding.

**M. neumogeni** Edwards.

From Arizona. Types are in the Neumoegen and Strecker collections and have extensive confluent fulvous markings. The figure in the *Biologia* represents a differing form which has been generally erroneously identified as *neumoegeni*.

**M. aryxna**, new species.

This is the form figured in the *Biologia Cent.-Am. Lep. Het.*, III, pl. 69, figs. 3 and 4. It differs from *neumoegeni* in having the fulvous markings considerably reduced, the outer band being broken into spots. I have ten specimens from Arizona from Dr. Barnes and Mr. Poling.

**M. ursus** Poling.

Arizona. Known only in the female.

## NOTES ON THE LARVÆ OF THE HESPERIIDÆ.

The larvæ of the North American Hesperiidæ have been much neglected, yet they offer a very interesting field for study. Of the foregoing species, only about forty have any larval observations published. Mr. W. H. Edwards, who has made known the life histories of so many North American butterflies, never seriously undertook the study of those of the Hesperiidæ, to our great loss.

The larvæ possess primitive setæ in the first stage with the generalized arrangement (Trans. N. Y. Acad. Sci., xiv, 52, fig. 3, 1895). After the first molt these are replaced by a coat of fine secondary pile. The neck is almost always small, the body is thickened centrally and tapers to the extremities. The feet are of the normal number.

After the first molt, when the primitive first stage is lost, there is usually very little change in the larva in structure or coloration, except the usual development of the markings. But one instance is known to me of marked change at the last molt, that of *batabano*. In this insect the larva is transformed at the last ecdysis from a smooth wine-red with bright yellow bands, to frosted white pitted by the non-pruinose areas about the setæ.

The relationships to the other families have been briefly stated by me (Ann. N. Y. Acad. Sci., viii, 231, 1894; Trans. N. Y. Acad. Sci., xiv, 61, note, 1895).

The food plants of the species are not as diversified as usual, grass and allied plants forming the food of many of the Pamphilinæ. The other groups feed on more various plants. None of the species known to me are general feeders or have any approach to such a habit; *tityrus* feeds on several plants, but they all belong to the pea family.

The larvæ almost invariably construct some shelter by spinning together leaves or parts of them into a box-shaped retreat. This is usually the first business of the newly hatched larva and the notches with the bitten part folded over formed in the edges of bean leaves by *proteus* or *tityrus* are characteristic of many other species. The larvæ of *Megathymus* are borers in the roots of *Yucca*, which habit has even caused some to think them allied to the Castniidæ, although the larvæ themselves really have no affinity therewith.

We hope that more study will be devoted to these larvæ in the future.



## Class I. HEXAPODA.

### Order IX, HEMIPTERA.

# THE GENUS NOTONECTA IN AMERICA NORTH OF MEXICO.

By J. R. DE LA TORRE BUENO,

NEW YORK, N. Y.

(PLATE VII.)

The Notonectidæ are one of the most interesting and, as far as coloration goes, handsomest families of the Cryptocerate Hemiptera, while the genus of which I treat is certainly the most brilliant in hues, nearly every species being of some striking color. But, as I have pointed out on other occasions,\* these are much neglected groups, and while some little work has been done in Europe in past times by the great masters F. X. Fieber, G. Mayr, Léon Dufour and others, and of late years by their learned successors, George W. Kirkaldy and Prof. A. L. Montandon, specialists in these families, in America nothing has been produced to compare with their work, save, perhaps, by Prof. Uhler, who is easily the premier American Hemipterist. Yet even he has taken up these neglected groups only as they came within the general scope of his speciality. The other Heteroptera are studied with greater or less closeness in proportion as they are useful or harmless, and most of them receive the special attention of the economic entomologist, but the aquatic forms are little collected and still less studied. Nevertheless, there is an economic aspect to these groups. Being predaceous, they are useful or harmful according to their prey. The great water-bugs of the family Belostomatidæ are stated by Uhler,† Howard‡ and others§ to be harmful where rice-culture is practised, as they are destructive to young fish. May and

\* "Notonectidæ of the Vicinity of New York," *Trans. Ent. Soc. Amer.* 1902. "Brief Notes toward the Identification of *Belostomatidæ* (Part I), with a few remarks on habits," *ibid.* 1903, 1905.

† *Standard Natural History*, 11: 237.

‡ *Insect Book*, p. 277.

§ *Proc. Ent. Soc. Wash.* 11: 2, 12, 24, 25.

the Notonectæ likewise destroy such as are sufficiently small to be overcome by them? I have seen nymphs of *Notonecta undulata* Say in the second instar kill and suck the juices of young fish which had just emerged from the egg in my aquaria. Prof. S. A. Forbes's two papers on the food of fresh-water fishes, in the Bulletin of the Illinois State Laboratory of Natural History \* show that they are of very little account as fish food. He says (*l. c.*) ; "Indeed, the true Waterbugs (Hemiptera) were generally rare, with the exception of the small soft-bodied genus *Corixa*, which was taken by one hundred and ten specimens, belonging to twenty-seven species—most abundantly by the sunfishes and top-minnows." Further on in the paper he tabulates the families, and in some instances, species, of insect fish-food, and contrasting with the number of fish above mentioned that ate *Corixas*, only *one* fish was found to have fed on Notonectas, out of the entire number examined.

Because of their apparent lack of economic importance, the knowledge of American forms is very imperfect and but scant information is available regarding their distribution, habits, life-history and anatomy. This I have found at every turn while consulting authorities. For this reason in the following pages I will endeavor to make it possible for anyone to identify with very little trouble any of the species of the genus *Notonecta* that occurs north of Mexico ; and by thus facilitating this identification and by pointing out gaps in our knowledge that might readily be filled, especially in distribution, induce others to collect and study a group which I am certain will be found eventually to be of positive economic importance, not only as an enemy in fish-culture, but possibly also in useful ways by the destruction of undesirable aquatic larvæ. The figures illustrating the various species will enhance the value of this paper, being true to nature and showing very perfectly the different physical characteristics of the waterbugs, being drawn to scale and in perfect proportion. They are the work of Mrs. William Beutenmüller, who is, I consider, one of our foremost insect artists. I here wish to express my appreciation of her great kindness in consenting to make these drawings.

The genus *Notonecta* Linné is of world-wide distribution, but appears to be more especially an American group. Of its twenty species

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\* "Studies on the Food of Fresh Water Fishes," Art. VII, Vol. II. "On the Food Relations of Fresh Water Fishes: A Summary and a Discussion," Art. VIII, Vol. II.

no less than twelve are peculiar to America, the thirteenth being European and Asiatic, also of these thirteen, eleven are to be found north of Mexico, three being, so far as records show, strictly boreal. It is not safe, however, to generalize regarding such variable and little-known insects, since errors readily arise from this practice. The described and recorded North American forms are *Notonecta indica* Linné (= *americana* Fabricius\*), *N. undulata* Say, *N. variabilis* Fieber, *N. uhleri* Kirkaldy, *N. mexicana* Amyot & Serville, *N. irrorata* Uhler, *N. lutea* Muller, *N. shooteri* Uhler, *N. insulata* Kirby, *N. montezuma* Kirkaldy, to which I add a new species, *N. howardii*.

*Notonecta indica* Linné is peculiarly a subtropical form and is found only in the warmer portions of the South and West, while *N. undulata* Say is of the widest distribution, ranging to my knowledge, from as far North as British Columbia and going down as far as Chile in South America, according to Kirkaldy. The distribution of *N. variabilis* Fieber is not so well known, but it is commonly found in the greater part of the United States. The very few recorded captures of *N. uhleri* Kirkaldy make it very difficult to fix its limits, but it is certainly to be found all along the Atlantic and Gulf seaboard of the United States. *N. mexicana* Amyot & Serville is more peculiarly tropical, but it comes in along our Southwestern boundary where the climate is warmer, extending up along the Pacific Slope for some distance, which appears to be the case also with *N. shooteri* Uhler and *N. montezuma* Kirkaldy, while on the other hand *N. irrorata* Uhler seems to be northern and eastern, being found only in the colder sections. In *N. insulata* Kirby we have a very peculiar distribution, the bug being in the East apparently boreal, but in the West it goes down into the warmer portions of the country. In *N. lutea* Muller we have an addition to our fauna, of much interest since the insect has heretofore been recorded only from Europe and Siberia.†

Considering the United States only, I have been unable to find any records of Notonecta from the following states: New Hampshire, Vermont, Delaware, West Virginia, South Carolina, Georgia, Mississippi, North Dakota, Alabama, Washington, Wyoming, and Arkansas, and Indian and Oklahoma Territories. The insect must certainly occur in them, since they are found in the neighboring ones. They must, for instance, be found in New Hampshire and Vermont, since

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\* Kirkaldy gives the Synonymy in "Über Notonectiden."

† Bueno, "A Palearctic Notonecta," Entomological News, XV, p. 220, June, 1904.

they occur in Massachusetts, New York, Maine, and the province of Quebec in Canada. I trust these gaps will be filled before long.

The habits of the Notonectæ are more or less well-known. They are exceedingly active and fiercely predaceous, resembling nothing so much as hawks among vertebrates. Their principal prey are such unfortunate insects as fall into the water within the ken of the watchful waterbug, or such of the feebler aquatic insects they can overcome, not disdaining their own young. From their position hanging back down at or near the surface, nothing escapes them, and at the slightest vibration imparted to the water by any struggling insect, or the least motion of one swimming by, they wheel swiftly about and with one or two powerful strokes of their long swimming legs, are on their prey and have it seized in their strong raptorial first and second pair of legs. They are strong and vigorous swimmers, and it is no great effort for a *Notonecta*, to pull under water and swim away with a struggling insect at least its own size, if not larger. I have, as before noted, seen a young nymph swim away with a fish at least twice its own size. Not all Notonectas hang from the surface constantly, however. *Notonecta undulata* does, and its raptorial claws can be seen forming little elevations as it hangs head down, while *N. insulata* seems to prefer to float in clear spaces in clean cold pools, about midway between the bottom and surface. On the other hand, *N. irrorata* and *N. uhleri* appear to like to hide among the roots of plants growing at the water's edge, to which they cling. The former may at other times also be seen floating below the surface in the shadow cast by bank or fallen tree or broken branch. The habits of *N. variabilis* differ somewhat from the others, since this bug prefers to lurk among the water weeds at the bottom.

The oviposition of *Notonecta* has thus far been always described from Régimbart's paper\* and the statement that the ova are buried in the stem of a plant has been handed down from generation to generation of entomologists as a precious heirloom, without question and without doubt. However, out of about 1,300 or 1,400 ova of four or five species that I have seen, some deposited in my aquaria and others taken in nature, I have thus far not found this so, save in the instance of one *N. undulata*, which did indeed insert them quite deeply in the stem of a water weed. All the others were simply

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\* "Observations sur la Ponte du *Dytiscus marginalis* et de quelques autres Insectes Aquatiques," Ann. Soc. Ent. Fr., 1875, p. 204.

attached in the manner described further on, although the plants in my aquaria were the same as for the one specimen, and although in the open I have found the ova on the watersoaked and decaying stems of rushes. It may well be, nevertheless, that since the bug observed by Régimbart was the European *Notonecta glauca* Linné its habits in this respect may differ from those of the American species I have been able to observe.

A word regarding collection and preservation of these waterbugs may not be amiss. Any approved water net will do. I use one made of coarse Brussels net, which is very strong and at the same time permits the water to flow through quickly, thereby offering very little resistance in the rapid movements necessary to secure these agile swimmers. The handle also should be rather long to give a good reach. To capture *Notonecta undulata*, the net should be moved swiftly back and forth just under the surface of the water at first; then when the bugs are hiding the vegetation should be dragged, the latter being also the best way to get *N. variabilis*. *Notonecta uhleri* and *N. irrorata* are best taken by dragging along the vegetation growing into the water from overhanging banks, not too near the surface, a tangle of roots in the water being in my experience the best place. For *N. irrorata*, the shadow of logs or broken branches lying in the water is a very favorable situation, and if the log lies in the water or floats on it the net should scrape the submerged surfaces. *Notonecta insulata* can be taken as it floats in the water by approaching the net slowly to the insect and then making a swift stroke, so that it meets the bug as it swims away. When under cover, the vegetation should be dragged as for the others. Not being familiar with the habits of the other species enumerated I can give no definite idea as to the best ways to catch them, but should think that some one of the preceding methods would apply.

The cyanide bottle is, of course, the most satisfactory way of killing them. *On no account should they be killed in alcohol.* This fluid distorts and discolors them, making them unfit for mounting. However, as a preservative of specimens for anatomical purposes, it is possibly the best. Formalin is not good; as while it preserves the insect, it so hardens the tissues that they become extremely brittle, even when wet. For mounting on pins, when it is not possible to do it in the field or for the moment, the water bugs should be kept dry, being put between layers of cotton protected by soft tissue paper, this

being also the best way of packing them for transportation. To soften them, they can be put with perfect safety into a little cold water, and in the course of an hour or so they will be sufficiently relaxed to be pinned without danger of breaking off legs, etc.

Living *Notonecta* for breeding or study should be put in a clean, dry tin box with a little excelsior in it to give them something to cling to, so they may not be too much shaken about or huddled together, which wets them and seems to be otherwise hurtful to them. It is wise also to put in with them a small piece or two of moist water-weed, which seems to help to preserve them in good condition till the aquaria can be reached. When in captivity, they should be fed on living flies or other small insects, which can be dropped into the water near them. One or two flies a day apiece appear to be enough to keep them in good condition.

In preparing the list of distribution I have consulted the papers indicated in the appended bibliography, and they will be denoted by the number each title bears in this list, which follows each locality. Other sources will be denoted by name.

The genus *Notonecta* is peculiar for the lack of a sufficiency of fixed diagnostic characters to facilitate the separation of the species by means of tables. Color is unreliable to a degree, varying as it does with locality, age, condition, or even without any assignable cause in the same species. For instance, the general coloration of *Notonecta undulata* Say, our most common and widespread species, varies from pure white with yellow scutellum, greenish feet and claret-colored eyes, to an entire black color, the feet and eyes remaining the same, and the scutellum being also black, with gradual and almost imperceptible intergrades from one to the other form. Occasionally, *N. variabilis* Fieber is found with black fasciæ corresponding to those of *N. undulata*, to such a degree that it may be taken for a dwarf form of the latter. In view of this, Kirkaldy has proposed as a diagnostic characteristic the proportion of the distance between the eyes at the front, which he has called the vertex, to the distance between the eyes at the base of the head, at the most constricted part, which he has denoted by the term *synthlipsis*. In practice, and I have made hundreds of measurements, I have found this proportion to hold good in each species within very narrow limits of variation; and in connection with the length of the insect and the proportional length and breadth of the pronotum and scutellum, it affords an excellent means

for separating them. I have used this method in the diagnostic tables following, being of the opinion that in general, proportional measurements of the hardened chitinous skeleton will be found to be constants in the majority of insects, and being more permanent than other characters, give an at all times reliable standard for the separation of species. This theory has not had the test of extended practical experience, except in this group, where hundreds of measurements have born out its efficiency.

### *Analytical Tables.*

#### Family NOTONECTIDÆ.

Rostrum 3- to 4-jointed, first pair of legs inserted on the posterior margin of the pronotum, scutellum large.

#### KEY TO THE SUBFAMILIES.

Hind tibiæ and tarsi ciliated, abdomen keeled, hairy, eyes very large, conspicuous.

*Notonectinae.*

Hind tibiæ and tarsi apparently not ciliated, abdomen neither keeled nor hairy, rostrum 3-jointed, eyes small.....*Pleinae.*

#### Subfamily NOTONECTINÆ.

#### KEY TO THE GENERA.

Eyes not contiguous at base, posterior femora not reaching the apex of the hemelytra.

Pronotum not very transverse, wings present, hemelytral area distinct.

1 (2) Last segment of the antennæ much shorter than penultimate, hind tarsi without claws .....*Notonecta.*

2 (1) Last segment of the antennæ much longer than the penultimate, hind tarsi with claws .....*Buenoa.*

#### Genus NOTONECTA Linné.

#### SYNOPSIS OF SPECIES.

1 (7 and 10) Small species, subrobust.

2 (5) Vertex twice or less than twice the synthlipsis.

3 (4) Vertex  $1\frac{1}{2}$  to two times the synthlipsis; width of pronotum one and three quarters times the length; width of scutellum one and one half times the length; length of insect 9.4 mm. to 11 mm. *indica.*

4 (3) Vertex twice the synthlipsis; width of pronotum one and four fifths times its length; width of scutellum one and one fifths times its length; length of insect 10.2 mm .....*howardii.*

5 (2) Vertex more than twice the synthlipsis.

6 Vertex two and one half times the synthlipsis; width of pronotum twice its length; width of scutellum one and one fifth times its length; length of insect 10 to 13 mm .....*undulata.*

7 (1 and 10) Small slender species.

8 (9) Vertex three times the synthlipsis; width of pronotum twice its length;

- width of scutellum one and one third times its length; length of insect 8.2 to 10.2 mm .....**variabilis**.
- 9 (8) Vertex six to eight times the synthlipsis; width of pronotum one and four fifths times its length; width of scutellum one and one sixth times its length; length of insect 10.7 to 12 mm .....**uhleri**.
- 10 (1 and 7) Medium-sized robust species.
- 11 (14 and 17) Vertex at least three times the synthlipsis.
- 12 (13) Vertex three to four and one half times the synthlipsis; width of pronotum two and one half times its length; width of scutellum one and one half times its length; length of insect 11 to 14 mm. **mexicana**.
- 13 (12) Vertex three times the synthlipsis; width of pronotum twice the length; width of scutellum one and one quarter times its length; length of insect 12.1 to 14.4 mm.....**irrorata**.
- 14 (11 and 17) Vertex less than three times the synthlipsis.
- 15 (16) Vertex two to two and one half times the synthlipsis; width of pronotum twice the length; width of scutellum one and one fifth times the length; length of insect 12.1 to 17 mm.....**lutea**.
- 16 (15) Vertex two and one half times the synthlipsis; width of pronotum one and six sevenths times its length; width of scutellum one and one fifth times its length; length of insect 13.1 to 14 mm. **montezuma**.
- 17 (11 and 14) Vertex not twice as wide as synthlipsis.
- 18 (19) Vertex one and one third times the synthlipsis; width of pronotum one and two thirds times its length; width of scutellum one and one third times its length; length of insect 8 to 13 mm. **shooterii**.
- 19 (18) Vertex but slightly wider than synthlipsis; width of pronotum twice the length; width of scutellum one and one fifth times the length; length of insect 12.6 to 15.5 mm.....**insulata**.

#### 1. *Notonecta indica* Linné.

##### *Notonecta indica*.

1771. Linné, "Mantissa Plantarum," p. 534.  
 1900. Kirkaldy, "Entomologist," p. 10.\*  
 1904. Kirkaldy, "Über Notonectiden," Wien. Ent. Zeit., p. 94.

##### *N. americana*.

1775. Fabr., Syst. Ent., p. 690, etc.\*  
 1811. Ol., Enc. Méth., VIII, p. 389.\*  
 1886. Uhler, Ch. List, p. 28.  
 1894. Uhler, P. Z. S., Lond., p. 223.  
 1897. Kirk., Rev. Not., Tr. Ent. Soc. Lond., p. 408.  
 1901. Champ., Biol. C.-A., Rhynch. II, p. 370, Tab. 22, fig. 11, female.

##### *N. unifasciata*.

1857. (?) Guérin, Le Moniteur, p. —.\*  
 1858. Guérin, Bull. Soc. Zool. Acclim., IV, p. 581.  
 1897. Kirk., Tr. Ent. Soc. Lond., p. 426.



*Description.* — "Head rather large, notocephalic lateral margins straight, not very divergent from the base; vertex varying from one and one half to twice as wide as synthlipsis. Scutellum rather shorter than in *N. undulata* Say. Hemelytra variable: (1) fulvous or dark stramineous, with a broad black fascia near the apex, occupying the basal two thirds of the membrane and the apex of the corium; (2) varying from bluish black to violet brown, the corial margins of the clavus and a broad irregular blotch about the middle of the corium, fulvous or dark stramineous. Otherwise like *N. undulata* Say." (Kirk., Rev. Not., p. 409.)

Long., 9.4 to 11 mm., lat., 3.4 to 3.6 mm.

*Distribution.* — United States (49), St. George, Utah (coll. mea), Humboldt Lake, Nevada (coll. mea and Van Duzee), Keeler Co., California (coll. Van Duzee), Arizona (coll. Heidemann and U. S. N. M.), Los Angeles, California (U. S. N. M.), Claremont, California (coll. mea), Rogue River, Oregon (U. S. N. M.), Alpine, Texas (O. S. U. coll.). This bug is extremely abundant in Lake Texcoco, Mexico, where its ova together with those of one or two *Corixas* are used as food under the name of "hauatle." It also occurs in Cuba, according to Kirkaldy.

The notocephalon, in conjunction with the size and coloration, will in the majority of cases serve to separate *Notonecta indica* Linné from *N. undulata* Say. As to color, however, there are some individuals from California in the U. S. National Museum collection, that of Mr. E. P. Van Duzee and my own, of the pure moonlight color of *N. undulata* var. *maculata*, from which, however, they are separated by the cephalic and pronotal structure. The Los Angeles *N. indica* grade from the typical broad black band across the corium to pure white, being in this somewhat similar to the variations in *N. undulata*. The average length of the insect is about 10 mm., although Kirkaldy gives it as ranging to 11 mm., and in the National Museum there is one specimen that measures only 9.4 mm.

## 2. *Notonecta howardii*, new species.

*Head.* — Notocephalic lateral margins curved; vertex twice as wide as synthlipsis; base of eyes about twice as wide as synthlipsis. Pronotum four fifths broader than long, humeral and lateral margins sinuate. Scutellum one fifth longer than wide, not concolorous. Hemelytra clouded with black going into smoky, and with a broad black band across the membrane and the apex of the corium. Apex of the membrane smoky. Corium and clavus moderately clothed with a golden pubescence. Membrane lobes subequal. Pedes: Intermediate femoral spur small, rather blunt, concolorous.

*Measurements.* — Vertex, 1 mm.; synthlipsis, .5 mm.; pronotum, lat., 3.5 mm., long., 1.9 mm.; scutellum, lat., 2.7 to 2.9 mm., long., 2.2 to 2.4 mm.; insect, long., 10.2 mm., lat. (pron.), 3.5 mm.; types, No. , U. S. N. M.

Described from two specimens in the U. S. National Museum, collected by Dr. E. A. Mearns in Arizona.

This waterbug is intermediate between *Notonecta indica* Linné and *N. undulata* Say. From the former it may be distinguished at once by the head characters; and the pronotum and scutellum will serve to separate it from the latter.

The preceding description is perforce very brief, as there were only the two somewhat old specimens to draw it up from, and I did not venture to spread the wings or otherwise prepare them for fear of destroying the insect. The colors are not mentioned (except black), as they change in old specimens and those preserved in alcohol; and the living or freshly caught insect may be very different in hue from those before me. Color characters, as pointed out in the introduction, are unreliable and misleading.

It affords me sincere pleasure to dedicate this, my first described insect, to Dr. L. O. Howard, to whom I am indebted for many kindnesses and much goodwill.

### 3. *Notonecta undulata* Say.

#### *Notonecta undulata*.

- 1832. Say, Descr. n. sp. Het. Hem., N. A., Fitch reprint, p. 812 LeComte Ed. Comple. Writ., 1859, p. 368, vol. I.
- 1851. Fieb. Rhyncholographieen, p. 55 (of separate).
- 1851. Fieb., Gen. Hydroc, p. 26 (of separate).
- 1874. Packard, Half hrs. w. Insects, pt. 5, pp. 139-41, fig. 103; ova, p. 159.
- 1875. Uhl., Bull. U. S. Geol. Surv. (2), V, p. 239, pl. 2, fig. 33.\*
- 1876. Glover, Ms. Notes, p. 54, pl. V, fig. 9.
- 1877. Uhl., Bull. U. S. G. & G. Surv., Bull., vol. 3, No. 2, p. 453.
- 1878. Uhl., Bull. U. S. G. & G. Surv., vol. IV, p. 509.
- 1878. Uhl., Proc. Bost. Soc. N. H., vol. XIX, p. 442.
- 1883. Packard, Guide, p. 537.
- 1885. Uhl., Stand. N. H., vol. II, p. 252 (partim).
- 1886. Uhl., Ch. List, p. 28 (partim).
- 1888. Comstock, Introduction, p. 186, fig. 157.
- 1889. Weed, Bull. Ohio Agr. Sta., Tech., Ser. I, p. 12, pl. 1, fig. 3.
- 1889. Garman, Bull. Ills. Laby. N. H., art. IX, vol. III, p. 174.
- 1891. Summers, Bull. Agr. Exp. Sta., U. of Tenn., vol. IV, No. 3, p. 82.
- 1890. Hyatt & Arms, Insecta, p. 121, fig. 70.
- 1894. Uhl., Proc. Calif. Acad. Sci., 2, vol. IV, p. 292.
- 1894. Van Duzee, Bull. Buff. Acad. Nat. Sci., vol. V, No. 4, p. —.
- 1895. Gillette & Baker, Bull. 31, Colo. Agr. Exp. Sta., Tech. Ser. I, p. 63.
- 1897. Kirk., Tr. Ent. Soc. Lond., p. 410.
- 1897. Smith, Ins. N. J., p. 144.
- 1899. Packard, Ent. for Beginners, p. 83.
- 1899. Comstock, Manual, p. 130, fig. 49.
- 1900. Osborn, Contr. Dep. Zool. and Ent. O. S. U., No. 2, p. 79.

1900. Luggier, Bull. 69, Ent. Div., U. of Minn., Agr. Coll. Exp. Sta., p. 15.  
 1901. Champion, Biol. C.-A., Rhynch., vol. II, p. 370, tab. 22, fig. 10, male  
 1901. Howard, Insect Book, p. 275.  
 1902. Bueno, Jour. N. Y. Ent. Soc., vol. X, pp. 231 and 233.  
 1904. Kirk., Wien. Ent. Zeit., pp. 94, 95 and 132.  
 1905. Bueno, Jour. N. Y. Ent. Soc., vol. XIII, p. 45.

*N. americana.*

1789. Gmel., in Linné Syst. Nat., ed. XIII, p. 2118.\*  
 1853. Herr.-Sch., Wanz. Ins., IX, pl. 44, pl. 294, fig. 902 (nec Fabr).\*

*N. punctata.*

1851. Fieb., Abh. Bohm. Ges. Wiss. (5), VII, p. 476 (in part).  
 1886. Uhl., Ch. List, p. 28.

*N. variabilis.*

1851. Fieb., l. c., p. 477 (in part).  
 1856. Guér., in La Sagra's Hist. de Cuba, vol. VII, p. 176.\*

*N. virescens.*

1852. Blanch., in Gay's Chile, Zool., vol. VII, p. 233.\*

*N. pallipes.*

1881. Leth., Ann. Soc. Ent. Belg., vol. XXV, p. 13 (nec Fabr.).

*Description.* — "Head diverging curvedly (varying in degree) from the synthlip-sis, which is not quite two and a half times less wide than the vertex. Pronotum very similar to that of *N. glauca* Linné, but the humeral margins as a rule not distinct. Scutellum not quite one fourth shorter than the metanotum, varying in color from pale luteous to black, with divers intermediate arrangements of the two colors; similar hemelytral markings occurring with dissimilarly colored scutella and vice versa. Metanotum varying from luteous to black, with three or more dark castaneous stripes; scutellar margin luteous. Hemelytra exceeding variable, giving rise to a number of well-marked varieties, though these are linked together by intermediate forms." (Kirk., Rev., p. 410.)

Long., 10 to 13 mm., lat. 3 to 4 mm.

*Distribution.* — My collection: Wood's Holl, Mass., Providence, R. I.; Long Island, N. Y., Staten Id., N. Y.; New York City, N. Y.; Putnam Co., N. Y.; Palisades, Rahway R. and Delair, N. J.; Raleigh, N. C.; Baltimore, Md.; Washington, D. C. (also colls. Heidemann and U. S. N. M.); Laval Co., Quebec, Canada; Lake Forest, Chicago and Urbana, Ills.; Onaga and Douglas, Kansas; Paige, Texas; Phoenix, Arizona; Bearfoot Mts., B. C.; Dilley, Oregon; Pasadena, Salton, and Three Rivers, California; Moscow, Idaho (coll. Van Duzee). Collection Heidemann: Maryland, Texas, and St. Kitt's, W. I. Collection U. S. National Museum: Rhode Island, Illinois, Indiana, Kansas, Central Missouri, Virginia; Lincoln, Nebraska; Louisiana, New Mexico, Colorado. Collection Ohio State University: Cedar Bluffs, Nebraska; Ames, Iowa. Albany, N. Y. (Coll. N. Y. State Mus.). Mt. Katahdin, Me. "U. S." (49), Buffalo, N. Y. (53), Madison and Caldwell, N. J. (38), Wauseon and Columbus, Ohio (31); Missouri and Indiana (37); Tennessee (39); Milk River Region, Montana (44); Shasta Co., California (51); Ft. Collins and Denver, Colorado (13); Sloan's Lake, Colorado (42). Minnesota (34); Michigan; Kentucky; Utah.

*Notonecta undulata* Say is by far the most widely-spread species to be found in America. It ranges from British Columbia down throughout the continent, spreading east and south and ranging down into Chile (according to Kirkaldy, Rev. Not.). The characters given under the preceding species serve to distinguish it from them and from *N. variabilis*, although small, white specimens of *N. undulata* may be confused with the latter. Kirkaldy has proposed three color-varieties for this bug, calling the pure white, or moonlight, color, with a sienna brown dot at the base of the membrane, var. *maculata*; the form with black fasciæ at the junction of the corium and membrane, var. *undulata*; and the fasciated form with corium suffused with black, var. *charon*. While these terms are somewhat useful, it is nevertheless impossible to draw a definite line between the various forms. In a long series, all intergrades are to be found, from the pure white, or moonlight color before mentioned, to an insect nearly all black, except for a little white on the clavus and corium, and a small, nearly round spot at the apex of the corium, next the membrane. There are in the National Museum collection five specimens from Louisiana collected by C. F. Baker, in which a broad black band occupies the posterior portion of the corium and the entire membrane. I have recently received this form from Dr. R. E. Kunzé, from Phoenix, Arizona. Otherwise, it is indistinguishable from the typical insect. Another specimen in the same collection, from Salt Lake, Utah, while having the notocephalic and pronotal structure of this species, in general contour and color may be taken for *Notonecta variabilis*. In the American Museum of Natural History, there is a specimen from Guadalajara, Mexico, which is practically entirely black, varying in tone from deep velvety to brownish black, where in typical specimens the white markings are.

As previously mentioned, this is the most common species of America and easily obtainable at all times. I have endeavored to breed it but have not succeeded in carrying it beyond the second or third instar, owing to the lack of proper food. However, having obtained a number of ova, I give the following description:

*Ovum*. — Length, 1.9 to 2 mm. Clear glistening pearly white when recently deposited. Chorion sculptured in irregular hexagons. Shape, elongate oval.

The only other descriptions known to me are a brief note by Prof. H. Garman in Bulletin Illinois State Laboratory of Natural History, Vol. III, where on page 174 he says the following: "The

eggs, which are elongated, cylindrical, and white, are attached to aquatic plants." Professor Packard, in "Half Hours with Insects," V, p. 159, also briefly refers to the ovum.

I have seen one *N. undulata* in the act of ovaposition, but not knowing what she was doing until too late, all I noticed was an in and out motion of the terminal abdominal segments, lasting possibly half a minute. When she swam away, there was the pearly white egg. I have frequently noted the parenchyma of the weeds slightly abraded, and in the groove thus formed, the ovum is placed.

#### 4. *Notonecta variabilis* Fieber.

##### *N. variabilis.*

- 1851. Fieb., Abh. Bohm. Ges. Wiss. (5), VII, p. 477 (in part).
- 1879. Berg, Ann. Soc. Cien. Arg., VIII, p. 74. (Reprint, p. 197.)
- 1897. Kirk., Tr. Ent. Soc. Lond., p. 414.
- 1902. Bueno, Journ. N. Y. Ent. Soc., vol. X, pp. 231 and 234.
- 1904. Kirk., Wien. Ent. Zeit., pp. 94 and 95.
- 1905. Bueno, Journ. N. Y. Ent. Soc., vol. III, p. 45.

##### *N. undulata.*

- 1885. Uhl., Stand. Nat. Hist. vol. II, p. 252 (in part).
- 1886. Uhl., Ch. List, p. 28.

##### *N. americana.*

- 1899. Ashm., in Smith's Ins. N. J., p. 144.

*Description.* — "Head, notocephalic lateral margins diverging curvedly from the narrow base, vertex about three times as wide as synthlipsis. Pronotum, width of posterior margin not quite twice as great as the length of the pronotum. Hemelytra, clear white inclining to yellowish, with a golden pubescence. Alar nervures pale golden yellow. Pedes and abdomen as in *N. undulata* Say." (Kirk., Rev., p. 414.)

Long., 8.2 to 10.2 mm., lat., 3.2 to 3.7 mm.

*Distribution.* — My collection: Van Cortlandt Pk., Ithaca, Putnam Co., Staten Island, N. Y.; Palisades, Rahway, R., Westfield, and Delair, N. J.; Chestnut Hill, Pa.; Lake Forest, Fourth Lake and vicinity of Chicago, Illinois; Washington, D. C.; Glen Echo and Bladensburg, Maryland; Montreal, Quebec; Raleigh, N. C. Hatch Experiment Station Collection; Amherst, Massachusetts; Pennsylvania, and Maryland. U. S. National Museum Collection: Lake Maxicuche, Indiana, Wisconsin, Michigan, Kansas, Rhode Island. Ohio State University collection: Maine; Columbus and Ashtabula, Ohio; Cedar Bluffs and Pine Ridge, Nebraska.

*Notonecta variabilis* Fieber is readily distinguishable from *N. undulata* by its smaller size, the largest *N. variabilis* barely equalling the smallest *N. undulata*; by the form being generally more slender; and by the shape of head and proportions of the notocephalon. At times, one meets an individual with black fasciæ somewhat resembling *N. undulata*, but the black is less bright and the markings less clean

cut. The general characters given will serve to separate it in all cases of doubt. There are in my collection some specimens in which the hemelytræ are stained a peculiar brownish black from the water, to a greater or less degree. In the national museum collection, there is a remarkably small specimen from southern California. It approaches in form and size *N. undulata*, var. *virescens*, from which, however, it can be readily separated by the notocephalic structure. It is only 8 mm. long and 2.8 mm. wide.

Prof. Uhler, according to his letters to Mr. Kirkaldy, is of the opinion that this species, *N. undulata* Say, and *N. indica* L. are mere varieties. But on the other hand, I have in my collection long series of both *N. undulata* and *N. variabilis* taken in this locality, and have never met with an intermediate form among them. On the contrary, I have found them always very constant to type. Then again, wherever *N. undulata* was found abundantly, *N. variabilis* was absent; and where I found large numbers of *N. variabilis*, I have taken not more than three or four *N. undulata* altogether. In my opinion, *Notonecta variabilis* Fieber is a good species, entirely distinct from *Notonecta undulata* Say.

The life-history of this water-bug, in common with all others of the family, is unknown. Breeding experiments have given me the ovum, which is very similar to that of *N. undulata*, except that it is naturally smaller, and perhaps a little more slender in proportion. I can also hazard a guess as to the number of stages, from field material and give approximately the period of embryonal development. Oviposition begins early in the spring, and continues thereafter, how late, I am unable to say. The ovum is deposited in a similar manner to that of *N. undulata*, mentioned previously, and the period of incubation is some 22 days on an average; this varies according to the conditions and temperature. Females in my aquaria have deposited some 30 ova each, but this cannot be an exact figure. The bugs arrive at maturity in the late July or early August, as shown by captures of recently transformed individuals. From nymphs taken at the same place on same date, it would appear that there are five nymphal instars, or perhaps, six. The adults pass the winter concealed in the mud at the bottom of the pools they frequent, emerge in the spring as soon as the ice is melted, and immediately begin to breed.

5. *Notonecta uhleri* Kirkaldy.*Notonecta uhleri*.

1897. Kirk., Ann. Mag. N. H. (6), XX, p. 58.\*  
1897. Kirk., Tr. Ent. Soc. Lond., p. 415.  
1902. Bueno, Jour. N. Y. Ent. Soc., vol. X, pp. 231 and 235.  
1904. Kirk., Wien. Ent. Zeit., p. 132.  
1905. Bueno, Jour. N. Y. Ent. Soc., vol. XIII, p. 46.

*Description.* — "Head: notocephalon in the form of an inverted wine-decanter, margins greatly curved, widely diverging toward the vertex, which is six to eight times wider than the synthlipsis, at which point, the eyes are almost contiguous; breadth of the eye about ten times as great as that of the synthlipsis. Pronotum: humeral angles acute, accentuated, lateral margins sinuate, humeral margins little separate from the posterior margin. Metanotum dark purple-brown. Hemielytra varying from dark brick-red to rich orange-yellow; a large irregular black blotch at the base of the corium extending transversely and nonacuminately from the apex of the clavus to the golden-yellow exocorial lateral submargin; membrane dark red-brown, apically black — this tint encroaching more or less basally. Alar nervures brown. Pedes: coxæ blackish; intermediate tibial spur blunt, subcylindrical. Abdominis dorsum: first and second segments rufotestaceous, deeper marginally, the remainder flavotestaceous, lurid marginally; this latter tint encroaching more and more apically. Abdominis venter rufotestaceous, densely provided with greenish black cilia." (Kirk., Rev., p. 415.)

*Distribution.* — Massachusetts (Uhler, Montandon and British Museum), New Orleans (Paris Museum), Florida (Uhler). My collection: Van Cortlandt Pk., New York (also colls. U. S. N. M., Davis and Heidemann); Putnam Co., N. Y.; Washington, D. C. (also coll. Heidemann); Palisades, N. J. "La.," U. S. N. M.

*Notonecta uhleri* was first described by Kirkaldy in 1897 (l. c.), from a male in the Uhler collection. It is a very rare bug, but so characteristic that its late description is remarkable. I have found records of only twenty-five specimens of this insect in collections, of which the type and one other are in Prof. Uhler's collection, a cotype in Mr. Kirkaldy's, two specimens in Mr. Otto Heidemann's, three in the U. S. National Museum, two in the British Museum, one in the Paris, another specimen in the collection of Mr. W. T. Davis, and the remaining thirteen in mine.

This waterbug is very noticeable on account of its bright color and peculiar notocephalic structure. It is impossible to mistake it for any other, although it approaches *N. variabilis* somewhat in size and general contour. I have touched on its habits previously, and nothing is known of its life-history or development. I have, however, gotten ova from a female taken in this vicinity, and they are undistinguishable from those of *N. variabilis*.

6. *Notonecta mexicana* Amyot & Serville.*Notonecta mexicana*.

1843. A. & S., Hist. Nat. Ins., Hem., p. 453, pl. 8, fig. 7.  
 1853. Herr.-Sch., Wanz. Ins., IX, p. 43, pl. 294, fig. 903.  
 1884. Uhl., Stand. N. H., p. 252.  
 1886. Uhl., Ch. List, p. 28.  
 1894. Uhl., Proc. Cal. Acad. Sci., ser. 2, vol. IV, p. 292.  
 1895. Gillette & Baker, Bull. 31, Colo. Agr. Exp. Sta., Tech. Ser. I, p. 63.  
 1897. Kirk., Tr. Ent. Soc. Lond., p. 401.  
 1901. Champ., Biol. C.-A., Rhynch. II, p. 368, Tab. 22, figs. 6, 6a-d.  
 1904. Kirk., Wien. Ent. Zeit., p. 94 and 132.

*N. klugii*.

1851. Fieb., Abh. Bohm. Ges. Wiss. (5), VII, p. 474.

*Description*. — "Head narrow at base, parallel for a short space, then sinuately diverging; vertex from three and one half to four and a half times as wide as synthlipsis. Pronotum very transverse, about two and one half times wider than long, lateral margins slightly sinuate, humeral margins gently and elongately curved, posterior margin not sinuate; humeral angles acute, accentuated. Metanotum not quite half as long again as scutellum, black (dark vars.) or violet brown margined with luteous (pale vars.). Hemelytra varying in color, membrane lobes subequal. Alæ semitransparent, smoky, nervures brown (pale vars.), or semitransparent smoky black, nervures blackish-brown (dark vars.). Abdominis dorsum black (dark vars.), or rufoluteous with paler genital segments (pale vars.). Abdominis venter varying from black to testaceous." (Kirk., Rev., p. 401.)

Long., 11 to 14 mm., lat., 4.5 to 4.8 mm.

*Distribution*. — U. S. National Museum collection: Bright Angel, Hot Springs, and Catalina Mts., Arizona; California. My collection: Pasadena and Sta. Clara, California. "W. States" (49), Fort Collins, Colorado (13).

The shape of the head and the very transverse pronotum separate it very readily from the other species of the genus. In his revision, Kirkaldy goes at length into the color variations, and since his remarks cover the ground exactly, I reproduce them here: "The hemelytra are usually rich scarlet, with black membrane, but the latter hue often extends beyond the apical margins of the clavus and corium; the scarlet also varies much in shade, graduating in one direction to pale greenish-white through pale yellow, pale olive-green, deep yellow, orange, and pinkish, and in the other through crimson and violet-red to deep violet-black, though in the last, the sutures of the hemelytral divisions are usually narrowly violet-red; in some specimens the apex of the corium is black, from the base of the membrane to the margins of the hemelytra in a straight line, and the rest of the hemelytra are rich crimson. The hemelytra are rarely maculate, occasionally the center of the clavocorial suture has a more or less



pronounced black smudge about the center. It may be convenient to propose the varietal names *ceres* for the pale-colored forms and *hades* for the southern violet black race. Herrich-Schaffer (l. c., p. 43) notes a variety with a large central ochreous stripe on the scutellum, while Fieber (l. c., p. 475) describes among the varieties with red hemelytra: (1) "Schild schmutziggelb mit braunem grund," and (2) "Schild braun mit gelblichem rand" — these three varieties I have not seen. In the U. S. National Museum and Heidemann collections the specimens from Colorado Cañon, Hot Springs and Catalina Mts., Arizona, are var. *hades*, and above the average size and with more prominent eyes. In the National Museum there is a specimen from Mexico which has the scutellum with the yellowish base (or apex) mentioned by Fieber (l. c., p. 475).

#### 7. *Notonecta irrorata* Uhler.

*Notonecta irrorata*.

- 1876. Uhler.
- 1876. Glover, Ms. Notes, p. 54.
- 1878. Uhl., Pr. Bost. Soc. N. H., vol. XIX, p. 443.
- 1883. Packard, Guide, p. 537.
- 1886. Uhl., Ch. List, p. 28.
- 1891. Summers, Bull. Agr. Exp. Sta., U. of Tenn., vol. IV, No. 3, p. 82.
- 1894. Van Duzee, Bull. Buff. Soc. Nat. Sci., vol. V, No. 4, p. 86.
- 1897. Kirk., Tr. Ent. Lond., p. 418.
- 1899. Smith, Ins. N. J., p. 144.
- 1900. Osborn, Contr. Dept. Zoöl. and Ent., O. S. U., No. 2, 8th Ann. Rept. O. St. Acad. Sci., p. 79.
- 1902. Bueno, Journ. N. Y. Ent. Soc., vol. X, pp. 231 and 235.
- 1904. Kirk., Wien. Ent. Zeit., p. 132.
- 1905. Bueno, Journ. N. Y. Ent. Soc., vol. XIII, p. 46.

*N. ornata*.

? Fitch Ms. (Signoret Coll.).\*

*Description*. — "Head small, notocephalic lateral margins diverging widely, vertex a little more than three times as wide as the synthlipsis; width of vertex and of the eye subequal; eyes rather larger proportionally than in *N. triguttata*, etc. Pronotum much wider basally than apically, lateral margins not sinuate, humeral angles acute, humeral and posterior margins sinuate. Hemelytra rich black, irrorated (especially on the clavus) with refulgent yellow brown, anterior lobe of membrane and apex of exterior lobe, smoky. The irrorations vary greatly in different individuals; in some the corium and membrane are almost immaculate, in others the whole of the valvus and corium is irrorated, imparting a checkered appearance, while in others the clavus is rich (almost metallic) yellow-brown with faint distant narrow black lines. Alar nervures brown. Pedes: intermediate tibial spur small. Abdominis dorsum: first to fifth segments black, sixth, seventh and eighth sordid grayish-brown. Abdominis venter black." (Kirk., Rev., p. 418.)

Long., 11.8 mm. to 14.4, lat., 3.6 to 4.7 mm.

*Distribution.*—My collection: Laval Co. and Montreal, Quebec; I haca, Putnam Co., Van Cortlandt, Staten Island and Long Island, N. Y.; Palisades, Rahway R., Westfield, and Delair, N. J.; Baltimore, Md.; Washington, D. C.; Lake Forest, Ills.; Columbus, Ohio (also recorded in 31). U. S. National Museum; Rhode Island; Lake Maxincuche and South Bend, Indiana. Buffalo, N. Y. (53), Tennessee (39), Madison, N. J. (38), and "U. S." (49). Keene Valley, N. Y. (State Museum), Wellington, Ohio, and Bladensburg, Md. (Coll. Heidemann). Montana (Coll. Van Duzee). Michigan, Kentucky.

The habits of this handsome bug are covered in the first part of these notes. It may not be out of place to call attention to a peculiarity it possesses in common with the other colored forms of the genus. On being removed from the water it has an evanescent bluish tinge on the hemielytra, caused doubtless by the pile that covers them. The same phenomena I have noted in *N. uhleri* and *N. insulata*.

#### 8. *Notonecta lutea* Muller.

*Notonecta lutea.*

1776. O. F. Muller, Zool. Dan., p. 103.\*

1814. Fall., Hydr. et Nauc. Sweciae, p. 6.

1851. Fieb. "Rhynchographien," Abh. Bohm. Ges. Wiss. (5), vol. VII, p. 473. (Separate, p. 49.)

1851. Lieb. Gen. Hydroc., p. 26.

1860. Flor. Rhynch. Livl., vol. I, p. 774.\*

1860. Fieb., Eur. Hem. (1), p. 100.

1875. J. Sahlbg., Not. Sallsk. Faun. Fenn. Forh., vol. XIV, p. 274.

1880. Puton, Hem. Fr., pt. 4, p. 218.

1891. Duda, Klub. prirod. Praze, p. 13, pl. IV, fig. 1.\*

1897. Kirk., Tr. Ent. Soc. Lond., p. 425.

1904. Bueno, Ent. News, vol. XV, p. 220.

1904. Kirk., Wien. Ent. Zeit., p. 132.

*N. unicolor.*

1835. Herr.-Sch., Nomencl. Ent., p. 63.\*

1848. Herr.-Sch., Wanz. Ins., vol. VIII, p. 23.\*

*Description.*—"Head large, notocephalic lateral margins slightly diverging from the base, vertex two to two and a quarter times as wide as synthlipsis. Entirely luteous (except the dark claret eyes, occasional dark-brown markings along the sutures of the clavus, etc., the bronze-brown sternal hair-tufts, the black unguiculi and venter). Scutellum a third wider than long. Exterior lobe of membrane about half the size of the interior lobe and obviously not so long. Alar nervures luteous. Pedes: spine on intermediate tibia large, acute, black-tipped." (Kirk., Rev., p. 425.)

Long., 13 to 17.1 mm., lat., 4.5 to 5.5 mm.

*Distribution.*—In Europe, Lapland, Finland, Sweden, Bohemia, Austria; in Asia, Siberia. North America, Bearfoot Mts., B. C. These localities are all taken from the various works cited, except the American, which is from specimens in my collection.

The presence of *Notonecta lutea* in the northwestern extremity of this continent is one of the curious facts in faunistics that are used as arguments to bolster up theories. I express no opinion on it, beyond calling attention to the fact that no theory of importation by man can account for its presence here, since it is not one of the parasitic Hemiptera, and the only seemingly reasonable explanation is a migration by some obscure means.

9. *Notonecta shooterii* Uhler.

*Notonecta shooterii*.

1894. Uhl., Proc. Cal. Acad. Sci., 2d ser., vol. IV, p. 292.

1897. Kirk., Tr. Ent. Soc. Lond., p. 406.

1901. Champ., Biol. C.-A. Rhynch., vol. II, p. 368.

1904. Kirk., Wien. Ent. Zeit., pp. 94 and 132.

*Description.* — "Head short, notocephalic lateral margins slightly diverging from the base and slightly converging towards the vertex, which is about one third larger than the synthlipsis. Pronotum large, rather longer in proportion to its width than in the other species, lateral and humeral margins sinuate. Scutellum small, nearly one third shorter than the metanotum; black, base purple-brown. Sterna sordid rufo-testaceous, hair-tufts black. Hemelytra black; clavus (apex excepted) dull ivory-white, corium more or less concolorous, forming with the clavus a blotch of varying extent, and usually with a whitish spot along the apical margin, the claval and corial markings very similarly disposed to those of *N. triguttata*; apex of membrane, smoky. The hemielytra, vary, however, very much, being quite violet black in some individuals (*melana*, var. nov.), while in others they are concolorous pale luteous. Membrane lobes always subequal in ordinary forms; generally unequal in the leucochroic varieties (*ochrothoe*, var. nov.), and rarely subequal (*tearca*, var. nov.). Alar nervures rich brown. Pedes: intermediate coxæ black, tibial spur small, rather blunt. Abdominis dorsum: segment 1 black, 2-5 violet-brown (the fifth apically black), 6 blackish, genital segments greenish-testaceous, all the segments more or less dull blackish laterally. Venter varying from green to black, carina and cilia black." (Kirk., Rev., pp. 407-8.)

Long., 8 to 13 mm., lat. pron., 4 to 4.7 mm.

*Distribution.* — San Diego, Cal., (51); Los Angeles, (U. S. N. M.), San Francisco (coll. Am. Mus. N. H. and mine), and Palo Alto, California. "California" (23).

Kirkaldy (l. c., p. 407), says: "Prof. Uhler informs me that in the U. S. National Museum there is a specimen of this species pure ivory-white. . ." I have had the good fortune to examine this and another similar specimen very closely. While in the absence of a long series and in deference to Prof. Uhler's determination they may for the time being be allowed to remain in this species, nevertheless they differ from the typical *shooterii* in being far more convex, the head apparently more flattened anteriorly, and in having a more

cylindrical pronotum. In typical examples the humeral angle is very distinct, but it is very much rounded and nearly obsolete in the leucochroic ones, both of which are from Mexico. The types of the bug are from California.

10. *Notonecta montezuma* Kirkaldy.

*Notonecta montezuma*.

1897. Kirk., Tr. Ent. Soc. Lond., p. 402.

1901. Champ. Bio. C.-A., p. 396, tab. 22, figs. 8, 8a ♂, 9 ♀.

1904. Kirk., Wien. Ent. Zeit., pp. 94 and 132.

*Description*. — Head narrow at base, similar to that of *N. mexicana*, notoccephalic lateral margins fairly straight, diverging from the base, vertex two and a half to three times as wide as synthlipsis. Hemelytra orange-red, suffused (especially marginally) with crimson, and sparingly and irregularly marked with black; membrane bluish-black, apex brownish-black, lobes subequal. Pedes: coxæ brownish-black, intermediate tibial spur, small, rather blunt. Abdominis dorsum: segment 1 black, 2 sordid testaceous, suffused with crimson and margined with black. Venter black." (Kirk., Rev., pp. 402-3.)

Long., 13.1 to 14 mm., lat., 4.7 to 5 mm.

*Distribution*. — Havilah, California. (Am. Mus. N. H. coll.)

It is interesting to record this bug from the United States, and the American Museum of Natural History is to be congratulated in the possession of this unique specimen among the other rare things in the Henry Edwards Collection. The type is a specimen from Mexico in the Hope Museum, Oxford. There is another specimen in the Paris Museum. I am aware of no other records. This addition to our fauna makes this article practical for the separation of all the known American species of the genus *Notonecta*, except the South American *N. bifasciata* Guérin and *N. nigra*, described by Fieber from Brazil, the latter being represented by only three specimens in collections.

11. *Notonecta insulata* Kirby.

*Notonecta insulata*.

1837. W. Kirby, in Richardson's Faun. Bor. Am., Ins., p. 285. (Reprint 1878, Can. Ent., vol. X, p. 216).\*

1851. Fieb., Rhyctographieen, Abh. köngl. böhm. Ges. Wiss. (5), VII, p. 475.

1875. Uhl., Rept. U. S. G. & G. Surv., vol. V, p. 841.

1876. Glover, Ms. Notes, p. 54 and pl. V, fig. 4.

1877. Uhl., Bull. U. S. G. & G. Surv., vol. III, no. 2, p. 453.

1878. Uhl., Bull. U. S. G. & G. Surv., vol. IV, p. 509.

1878. Uhl., Proc. Bost. Soc. N. H., vol. XIX, p. 442.

1886. Uhl., Ch. List, p. 28.

1894. Van Duzee, Bull. Buff. Soc. Nat. Sci., vol. V, no. IV, p. 186.

1895. Gillette & Baker, Bull. 31, Tech. Ser. I, Agr. Exp. Sta., Ft. Collins, Colo., p. 63.

1897. Kirk., Tr. Ent. Soc. Lond., p. 403.

1899. Smith, Ins. N. J., p. 144.

1902. Bueno, Jour. N. Y. Ent. Soc., vol. X, p. 231-2.

1904. Kirk., Wien. Ent. Zeit., pp. 94 and 132.

1904. Uhl., Proc. U. S. N. M., vol. XXVII, p. 364.

1905. Bueno, Jour. N. Y. Ent. Soc., vol. XIII, p. 46.

*N. impressa.*

1851. Fieb., Abh. Bohm. Ges. Wiss., (5), vol. VII, p. 475.

1886. Uhl., Ch. List, p. 28.

*N. rugosa.*

1851. Fieb., l. c., p. 476.

*N. fabricii.*

1891. Towns., Proc. Ent. Soc. Wash., vol. II, p. 56 (nec. Fieb.).\*

*Description.* — "Head; notocephalic lateral margins fairly straight and nearly parallel, very slightly constricted near the base; vertex little wider than synthlipsis, which is about one fourth less than the width of the base of the eye. Lateral and humeral margins of the pronotum sinuate. Scutellum varying slightly in length, but occasionally reaching and usually nearly reaching the base of the metanotum, black (Fieber in *N. rugosa* records two varieties (*cordigera* and *basalis*) with yellowish scutellum, but I have not seen them). Hemelytra variable in pattern and color \* \* \* Alæ, basal nervures crimson, the others yellow-brown. Pedes: coxæ black, intermediate tibial spur small, slender, not tipped with black. Abdominis dorsum: segment 1 black, 2-6 brilliant scarlet, 7-8 reddish-testaceous. Abdominis venter black, connexivum and central carina green." (Kirk., Rev., pp. 403-4.)

Long., 12.6 to 15.5 mm., lat., 4.8 to 5.6 mm.

*Distribution.* — My collection: Montreal, Quebec; Bearfoot Mts., B. C.; Dillley, Oregon; Woods Holl, Mass.; Albany, Long Island, New York City and Staten Island, New York; Delair and Palisades, N. J.; San Luis Obispo, Claremont, Mt. Diablo, Santa Clara Co. and Pasadena, California; Humboldt Lake, Nevada (also in coll. Van Duzee); Ft. Collins, Colorado (also Van Duzee coll.); U. S. National Museum Collection: Hartford, Conn.; Indiana; Nebraska; Flagstaff, Arizona; Colorado; Las Vegas, New Mexico; Warner Lake, Oregon; Salt Lake, Utah; Palm Springs, Placer County, Santa Barbara and San Diego, California. Collection Heidemann: Palo Alto, California; Lakeside, S. D. Collection Ohio State University: Maine; Pine Ridge, Nebraska; Peach Springs, Arizona. Black Hills, Dakota (Am. Mus. N. H.); Orono, Maine, and Andover, Mass. (Hatch Exp. Sta.); Da Costa, N. J. (38); Buffalo, N. Y. (53); Denver, Colorado (13); Owens Valley, California (43); Milk River region, Montana (44); Las Vegas Hot Springs, New Mexico (52). I have also seen specimens from Mt. Katahdin, Maine.

Kirkaldy recognizes five color varieties (omitted in the preceding copy of his description), but while such terms may at times be convenient, it is as difficult in this species, as it is in *N. undulata* to draw a fixed line of demarkation to separate them. It ranges through vari-

ous degrees of fuscous, greenish-white and testaceous, all more or less marked with black, which color, however, is sometimes absent. Prof. Uhler at one time was of the opinion that the European *N. glauca* L. was to be found in America, basing it on the light-colored unicolorous individuals that are at times to be found in the Eastern United States. Individuals from mountainous regions are in general somewhat stouter in form, with flattened heads and more strongly arched pronotum.

I wish here to express my gratitude to the gentlemen who have in many ways most kindly helped me in this work: To Dr. L. O. Howard for the privilege of working over the U. S. National Museum material; to Mr. George W. Kirkaldy for much encouragement and valuable assistance in many ways; to Professor Herbert Osborn, Mr. Otto Heidemann, Mr. E. P. Van Duzee, Prof. H. T. Fernald, and many other gentlemen for gifts and loans of specimens.

In conclusion, I may say that the deficiencies of this article are very evident to me. It had been planned on more extensive and minute lines, but the unfortunate difficulty in obtaining material from our Southern and Western States has put such work out of the question for the time being. Therefore, I determined to present to observers such of my partial results as were in a more advanced stage, in order to arouse interest and make possible the completion at some later date of a genuine monograph of the entire family for the region I treat of here. For the same reason, I have reproduced in extenso Mr. Kirkaldy's descriptions, as they are so excellent that with them the work of identification of the species is much simplified; and also, I wished to make them accessible to American workers. I trust that my work will be of help to all who avail themselves of it.

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## EXPLANATION OF PLATE VII.

- Fig. 1. *Notonecta indica* Linné.
  - Fig. 2. *Notonecta undulata* Say.
  - Fig. 3. *Notonecta variabilis* Fieber.
  - Fig. 4. *Notonecta uhleri* Kirkaldy. (Drawn from cotype.)
  - Fig. 5. *Notonecta mexicana* Amyot & Serville var. *ceres* Kirkaldy. (Drawn from cotype.)
  - Fig. 6. *Notonecta irrorata* Uhler.
  - Fig. 7. *Notonecta lutea* Müller.
  - Fig. 8. *Notonecta shooterii* Uhler.
  - Fig. 9. *Notonecta insulata* Kirby.
- All enlarged three diameters.

## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF NOVEMBER 15, 1904 (continued from page 102).

Mr. Davis read a letter from Mrs. Annie Trumbull Slosson, in which she stated that she had taken in pools of brackish water in southern Florida, an undetermined *Limnobates*, a specimen of which she sent for comparison with *Limnobates lineata* spoken of by Mr. Bueno. She also referred to her finding of *Halobates wullersterfi* on the beach at Lake Worth, Fla. She published a record of this in 1901 and no other record is known of their occurring on land, their usual habitat being far out at sea. She also sent specimens of *Brenthus anchorago* to show the great variations in size, remarking that she had taken it in numbers in its breeding places under the bark of gumbo-limbo (*Bursera gummifera*) but had also found it frequently on

flowers in the sunshine. She referred to the capture of *Cylas formicarius* whose food plant she was the first to discover several years ago. It breeds in the stems of an odd "morning glory" (*Ipomoea pes-caprae*) which trails along the beaches of Southern Florida. She expressed her regrets at not being able to attend the meetings of the society.

MEETING OF DECEMBER 6, 1904.

Held at the American Museum of Natural History. President C. H. Roberts in the chair with nine members present.

On motion of Mr. Groth the society voted to dispense with the regular order of business and proceed to the discussion of new business. Mr. Groth gave notice that he would like to have brought before the society at its next meeting a former tabled motion of his, that the Journal be furnished free of cost to active members in good standing.

Mr. Schaeffer exhibited a box of the rarer Cleridæ and made some remarks on the species.

Mr. Leng and Mr. Davis also exhibited their collections of Cleridæ.

Mr. Joutel exhibited his collection of *Saperda* representing nearly all of the known species of the United States, Europe and Asia. He gave an account of the manner of working of most of the species and exhibited specimens of wood showing their characteristic borings.

An exhibition of *Cicindela longilabris* Say and its varieties was made by Mr. Harris, accompanied with remarks concerning the distribution of the species and the relation of the variety to the type. Special attention was called to a very full series of the form taken at Kaslo and its vicinity in British Columbia by Mr. Cockle. *Longilabris* proper was represented in part by long series from Mt. Desert on the Maine Coast, Cape Breton, Province of Quebec and the Adirondack region of New York State.

Mr. Davis stated that a friend had recently sent him a specimen of *C. longilabris* from Long Lake, in the Adirondack Mts., some forty miles west of where Mr. Harris took his specimens last summer on Jay Mt.

Mr. Bueno showed a specimen of *Nerthra stygica* Say, from Mrs. Slosson's collection. He stated briefly that Prof. A. L. Montandon, of Bucarest, failed to recognize this species in his revision of the subfamily Mononychinae, stating that this insect has not been recognized since Say's original description, the date of which is uncertain, but according to Prof. Uhler was in March, 1832. Prof. Montandon further states that in view of Say's description it is evident that the insect does not belong to the genus *Mononyx*, but more likely to *Peltopterus* Guérin. Mr. Bueno called attention to the fact that *Nerthra stygica* certainly does not belong to the genus *Mononyx* as now restricted, approaching more closely to *Peltopterus*. In his opinion Say was right in erecting a new genus for its reception, of which the characters are: absence of membrane in the hemielytra, which are entirely coriaceous and soldered together by a straight suture. He showed for comparison specimens of *Mononyx nepesformis* and *M. fuscipes*, from which the roughened upper surface of *Nerthra* is sufficient to separate it. He also showed a *Mononyx* from Biscayne Bay, Florida, belonging to Mr. Otto Heidemann, which would seem to be a new species.



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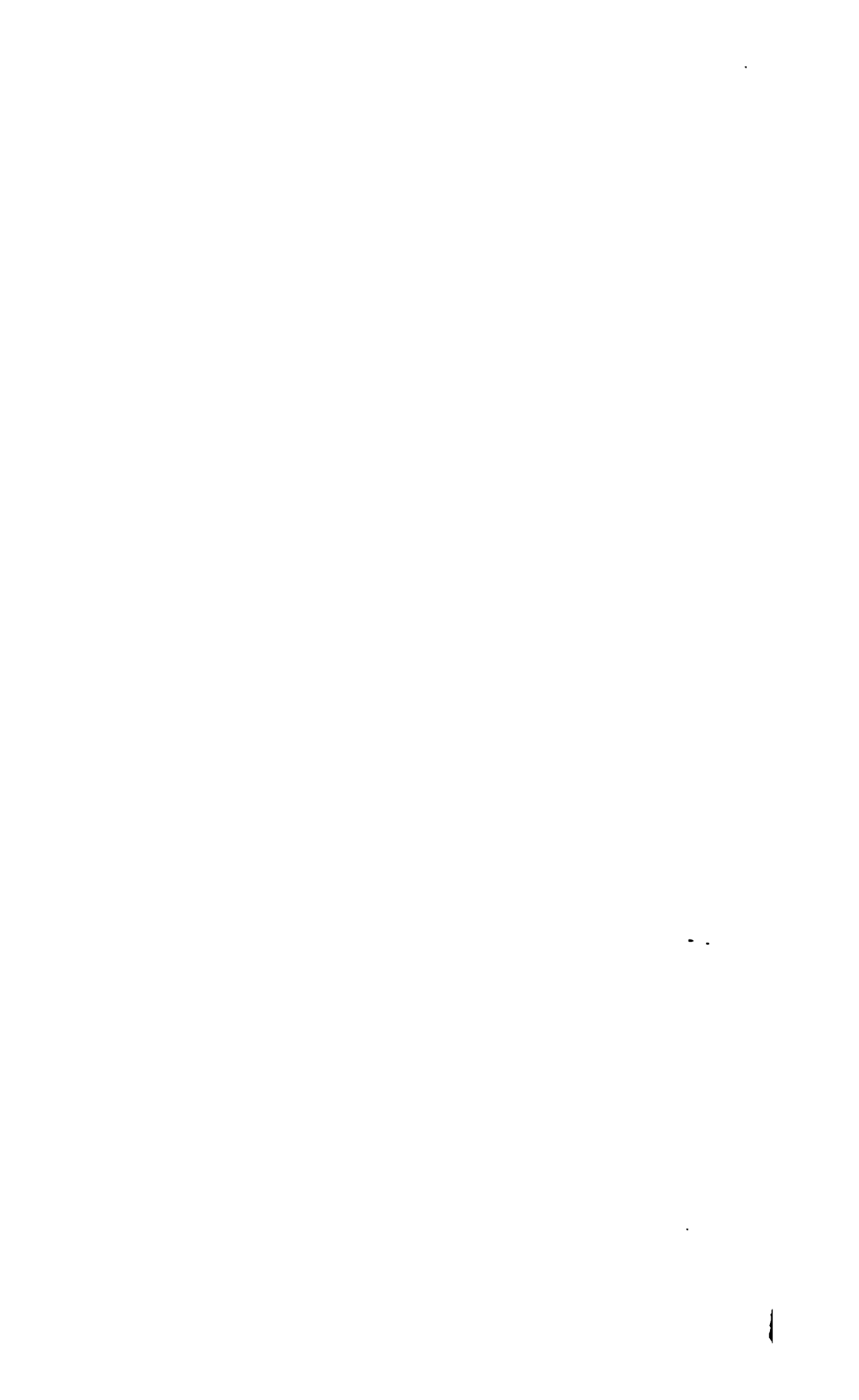
8



9

*E. L. Beutenmüller.*

Notonecta of North America.



# THE NEW YORK ENTOMOLOGICAL SOCIETY.

Organized June 29, 1892.—Incorporated June 7, 1893.

The meetings of the Society are held on the first and third Tuesday of each month (except June, July, August and September) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Eighth Ave.

Annual dues for Active Members, \$3.00.

Members of the Society will please remit their annual dues, payable in January, to the treasurer.

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### Class I, HEXAPODA.

#### Order II, COLEOPTERA.

### ON THE AFFINITIES OF THE GENUS TACHY- CELLUS, WITH DESCRIPTIONS OF NEW SPECIES FROM THE WESTERN UNITED STATES.

By H. C. FALL,

PASADENA, CAL.

The first reference to the genus *Tachycellus* in our literature was made by LeConte in his "Notes on the Species of *Agonoderus*, *Bradycellus* and *Stenolophus* Inhabiting America North of Mexico." \* In this paper, which was prompted by one on North American Carabidæ by Chaudoir, † LeConte declares himself not ready to follow the French author in referring certain of our species to *Tachycellus* Moraw., which species he retains as Group A of *Bradycellus*, as follows :

*dichrous* Dej.  
*vulpeculus* Say.  
*autumnalis* Say.

*badiipennis* Hald.  
*atrimedius* Say.  
*nebulosus* Lec.  
*nigrinus* Dej.  
*tibialis* Kirby.

In his Genera of Carabidæ (1881), Dr. Horn admits the validity of *Tachycellus* for the species of the second column above, and transfers those of the first column to *Harpalus*. Two years later Horn gives in the Brooklyn Bulletin ‡ a synoptic table of *Tachycellus*, in

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\*Proc. Acad. Nat. Sci. Phila., 1868, p. 373.

† Revue et Mag. de Zoologie, 1868.

‡ Bull. Brook. Ent. Soc., VI, 1883, p. 51.



which the species stand precisely as now recorded in the Henshaw list, viz.:

**nigrinus** Dej.  
**kirbyi** Horn.  
**atrimedius** Say.

**nebulosus** Hald.  
**badiipennis** Hald.  
**nitidus** Lec.

In this treatment of the genus, *tibialis* is made a synonym of *nigrinus*, *nitidus* (withdrawn from LeConte's Group B of *Bradycellus*) is admitted, and *kirbyi* is new, the brief tabular characters serving for its description.

The sole criterion offered by the "Classification" for the distinction of *Tachycellus* from *Bradycellus* lies in the number of glabrous joints of the antennæ, these being three in the former, and two only in the latter genus. This character is assumed to be constant, but investigation shows that it is not strictly true of *nigrinus*, in which the third joint is clothed somewhat sparsely in its apical half with the same kind of pubescence as the following joints. The same condition exists in a second species—*turbatus*—to be described in the present paper. Another character of importance, mentioned by LeConte and Horn, is the presence of squamules on the lower surface of the middle tarsi in *Tachycellus* (except *nitidus*), and the absence of such squamules in *Bradycellus* (except *linearis*). The two exceptions named were each made the type of a distinct genus (*Glycerius* and *Amerinus*) by Casey in 1884, both of which were shortly after repudiated by Horn. The characters used by Casey seem, it is true, of somewhat trifling moment, but the elimination of these two aberrant forms at least possessed the merit of leaving *Bradycellus* and *Tachycellus* more homogeneous, and separable by one constant character. I have not seen Morawitz's description of *Tachycellus*, but from the remarks of subsequent authors it seems clear that he based the genus chiefly upon the tarsal character above named, and laid little if any stress upon the number of glabrous joints of the antennæ, which for aught I know he may not have mentioned at all. At all events they are not alluded to by Seidlitz in his *Fauna Transylvanica*, nor does Ganglbauer use the character in his more recent masterly treatment of the *Käfer von Mitteleuropa*. The latest European Catalogue—that of Heyden, Reitter and Weise—follows Seidlitz, who characterizes the genus thus:

Tarsi above and eyes hairy; mentum toothed, scutellar stria rarely present; prosternum not margined in front, hind tarsi not grooved; male with a more densely punctured and pubescent spot on the abdomen, just back of the hind coxæ, and with the front tarsi furnished beneath with two rows of squamules.

As thus constituted the genus includes *cognatus* Gyll — placed as a *Bradycellus* in our lists — and several allied forms, all of which Ganglbauer has properly transferred to *Dichirotrichus* Duval on the basis of the presence of a seta in the hind angle of the prothorax, creating for them the subgenus *Trichocellus*, typical *Dichirotrichus* having the male front tarsi pilose rather than squamulose beneath, and the upper surface of the body conspicuously pubescent and rather closely punctured throughout. The latter author regards *Tachycellus* as merely a subgenus of *Bradycellus*, separable by its squamose middle male tarsi, these being simple in the true *Bradycellus*; a single small species (*similis* Dej.) is referred to it.

What now is the bearing of this upon the disposition of our own species? The interpretation of Seidlitz is totally different from that of either Le Conte or Horn, and would exclude all the species we now refer to the genus, substituting for them *cognatus* alone. The view of Ganglbauer is more nearly in accord with that of our own authors, and if we reverse in order of importance the antennal and tarsal characters, the desirability of which is indicated above from a study of our own species, the two become practically identical. The question as to whether the differences in the modification of the male tarsi are to be regarded as of generic or subgeneric import is of course a matter of opinion; Ganglbauer holds the latter view; I am inclined to the former. Such characters are commonly held to be of rather more than ordinary importance, and are almost invariably associated with others which, if somewhat trivial in themselves, assume an added importance in conjunction with the former; moreover, in the present case, clearness of exposition is certainly facilitated thereby.

Let us pass briefly in review the species of *Tachycellus* as they now stand in the Henshaw list. It is first necessary to remove *nebulosus*. An examination of the LeConte type during a recent visit to Cambridge shows it to be a typical *Bradycellus*, closely resembling and probably not distinct from *rupestris*. *Nitidus* is a very aberrant form and cannot be retained in the genus, the only reason for so associating it being the nearly glabrous third joint of the antennæ. It is more nearly related to *Bradycellus*, but does not properly enter there and the proper course would seem to be to restore Casey's genus *Glycerius* for this and several allied forms to be herein described.

The remaining species agree in possessing the fundamental tarsal characters of the genus, and all, with the exception of *nigrinus*, have

the finer pubescence of the antennæ beginning on the fourth joint. *Badiipennis*, in its rounded posterior thoracic angles, departs somewhat in facies from the other three. Regarding these four species together with two undescribed forms in my collection as exponents of the genus, the latter may be characterized as follows :

**Genus TACHYCELLUS Morawitz.**

Penultimate joint of labial palpi not longer than the terminal joint and bisetose in front; front and middle tarsi of males with two rows of squamules beneath, the former moderately, the latter (except rarely) feebly or scarcely dilated, the fourth joint emarginate; mentum toothed; finer pubescence of the antennæ commonly beginning on the fourth joint, more rarely at the middle of the third; body throughout glabrous; side margin of prothorax with a single seta before the middle; elytra normally striate and with a single dorsal puncture; prosternum non-setose at tip; abdomen without pubescent spot in the male.

TABLE OF SPECIES.

Antennæ with three glabrous joints.

Hind angles of thorax sharply defined and nearly rectangular.

Legs pale.

Prothorax testaceous, with large piceous spot; width at base not greater than the length.....*atrimedius*.

Prothorax piceous, marginal bead alone paler; width at base a little greater than its length.....*kirbyi*.

Legs piceous, the tibiæ paler at base.....*conformis*.

Hind angles of thorax obtuse, rounded.....*badiipennis*.

Antennæ with two glabrous joints, the third pubescent in outer half, though less conspicuously so than the following joints.

Hind angles of thorax rectangular, middle tarsi scarcely dilated in the ♂.

*nigrinus*.

Hind angles of thorax obtuse, scarcely rounded; middle tarsi of male nearly as widely dilated as the front tarsi.....*turbatus*.

**T. atrimедius** Say, Trans. Am. Philos. Soc., II (1823), p. 39.

"Length 7 mm. Black; prothorax and elytra testaceous, the former with a large quadrate black spot, the latter with a dusky cloud divided by the suture; body slender; prothorax distinctly narrowed behind; hind angles subrectangular, slightly prominent, not rounded; basal impressions broad, punctured; antennæ with joints 1-3 testaceous, legs testaceous." (LeConte's description.)

Occurs from New England and Canada to Texas. Always easily recognizable by its coloration.

**T. kirbyi** Horn, Bull. Brook. Ent. Soc. VI (1883), p. 51.

Length 6 mm. Blackish, the elytra gradually becoming castaneous or piceo-castaneous toward the base and sides; epipleuræ, marginal bead of thorax, legs, and basal three joints of antennæ paler. Prothorax moderately narrowed behind, the

length rather less than the width at base; basal impressions broad and moderately deep, thickly punctured.

“Canada and Ohio.”

At once distinguishable by its stouter form and darker color from the more common *atrimedius*, the only other species with sharply defined posterior thoracic angles occurring in the same region.

**T. conformis, new species.**

Length 6.5 mm. Black, shining, basal joint of antennæ pale; legs piceous, the tibiæ, especially at base, somewhat paler. Prothorax distinctly narrowed behind, slightly wider at base than long at the middle; hind angles nearly right; basal impressions broad, very finely and quite sparsely punctate; elytra finely striate.

Washington and California.

Described from a single female specimen from Washington (State), sent me years ago as *nigrinus*. As compared with *nigrinus* it is larger, the thorax more narrowed behind, basal impressions widely punctate (nearly or quite impunctate in *nigrinus*), third joint of antennæ glabrous, elytra more finely striate.

The latter locality — California — is represented by several examples taken by Dr. Fenyès at Pt. Reyes. There is also an example in the LeConte collection, the specimen being placed with *nigrinus*.

**T. badiipennis** Hald., Proc. Acad. Nat. Sci. Phila., I (1883), p. 302.

“Length 5–6 mm. Blackish; bead of prothorax pale; elytra piceous or dark testaceous; body more slender; prothorax distinctly narrowed behind; hind angles obtuse, rounded; basal impressions well marked, sparsely punctured; legs ferruginous, thighs and tips of tibiæ sometimes darker; first joint of antennæ pale.” (LeConte’s description.)

This species ranges from New England and Canada to Virginia and Kansas.

**T. nigrinus** Dej., Spec. IV (1829), p. 39.

“Length 5.5–6.5 mm. Black, shining, not iridescent; prothorax with hind angles rectangular; basal impressions linear, strongly marked, smooth, or scarcely punctured; anterior transverse impressions distinct, strongly angulated; upper part of tibiæ and first joint of antennæ testaceous.” (LeConte’s description.)

Alaska, Lake Superior, New Mexico (Beulah), Northern California (McLond, Fenyès).

The prothorax is less narrowed posteriorly than in any of our other species.

**T. turbatus, new species.**

Robust, feebly convex, piceous black with very faint greenish surface lustre, marginal bead of prothorax, legs, and antennæ pale. Antennæ a little less than half

the length of the body, rather more slender than in *badiipennis*; pubescence beginning at the middle of the third joint. Prothorax moderately transverse, widest before the middle; sides arcuately converging to base which is slightly wider than the apex; base angles obtuse, scarcely rounded; median line fine and complete; basal impressions broad with about eight minute punctures at the bottom of each impression. Surface otherwise impunctate. Elytra two fifths wider than the prothorax and seven tenths as wide as long; striæ fine, impunctate, intervals flat; apex rather strongly sinuate. Front and middle tarsi broadly dilated in the male, the fourth joint emarginate. Length 5.5 mm., width 2.5 mm.

New Mexico.

Described from two examples (♂ ♀) collected at Beulah (8,000 ft.), and Cloudcroft (9,000 ft.) by Cockerell and Knaus respectively.

As the genera are at present defined this species will prove a disturbing element wherever placed. The third joint of the antennæ being pubescent in apical half would, strictly speaking, exclude it from *Tachycellus*, but the same is true of *nigrinus* which has long occupied a place in the genus. The middle tarsi are nearly as widely dilated as the front ones in the male of *turbatus*, but much less so in typical *Tachycellus*. *Turbatus* cannot, however, be included in *Stenolophus* because of the toothed mentum and non-bilobed fourth tarsal joint, nor can it be referred to *Bradycellus* because of the squamose intermediate male tarsi. Of the species now referred to *Tachycellus*, *turbatus* most resembles *badiipennis*, though distinctly more robust.

Genus GLYCERIUS Casey.

This genus was established by Casey for the *Acupalpus nitidus* of Dejean, subsequently referred to *Bradycellus* by Mannerheim and LeConte, and to *Tachycellus* by Horn. The species represent a well marked type, differing conspicuously in facies and in combination of structural details from any of the genera with which it has been associated, and notwithstanding its rejection by Horn, the genus appears to me to be well founded. In Casey's short diagnosis much stress is laid upon the numerous marginal setæ of the prothorax. The character is indeed a remarkable one but it possesses absolutely no weight from a generic standpoint, there being only the normal single seta each side in each of the new species described below, all of which are certainly congeneric with *nitidus*. Briefly the principal characters of the genus are as follows:

Mentum toothed; front tarsi (♂) rather feebly dilated and biserially squamulose, middle tarsi undilated and without squamules; antennæ with three glabrous

joints; scutellum short and broad, only feebly entering the elytral disk; upper surface glabrous, polished; elytra with the sutural stria alone impressed, the others feeble or completely effaced; dorsal punctures wanting; lower surface sparsely punctured and pubescent, tip of prosternum plurisetose, abdomen in the male with two small densely punctured and pubescent spots (sometimes confluent) on the second and third segments.

## TABLE OF SPECIES.

Prothorax at sides plurisetose; size large (5-7 mm.) color usually entirely or in great part testaceous.....**nitidus.**

Prothorax at sides unisetose, color piceous, usually more or less bronzed, rarely obscurely suffused with testaceous.

Hind angles of prothorax rectangular or very nearly so, abdominal pubescent spots in the ♂ well separated; size smaller (3.5-5 mm.).....**politus.**

Hind angles of prothorax obtuse, the prothorax more distinctly narrowed posteriorly; abdominal pubescent spots in the male confluent; size small.

Sides of prothorax slightly sinuate before the hind angles, the latter more sharply defined; elytra three times as long as the prothorax.

**intermedius.**

Sides of prothorax scarcely visibly sinuate before the angles, which are less sharply defined ; elytra two and one half times as long as the prothorax.

**obtusus.**

**G. nitidus** Dej.

This is our largest species and may always be recognized by the numerous marginal setæ of the prothorax. These setæ are about seven in number and more closely placed in front; there is no seta in the hind angle. The color in California specimens is commonly entirely testaceous, but specimens are frequently seen having two elongate discal spots on the thorax, and a discal stripe on the elytra black. The black color is inclined to spread by diffusion, but I have never seen specimens from our territory with either thorax or elytra entirely dark. In a series of Mexican specimens before me the elytra are entirely black in some specimens while in others the entire upper surface is thus suffused. These are the *obsoletus* of Say. As observed by Bates in the Biologia, the form in the Mexican specimens seems a little more elongate than in those from California, but the difference is elusive and it is probable that Horn was correct in declaring them identical. The elytral striæ except the sutural, which is always sharply impressed, are very variable. Commonly there are faint traces of one or more discal striæ and occasionally these are all discernible; in many specimens however they are completely effaced. The pubescent spots of the second and third segments are very small and separated by a distance rather greater than their own diameter.

The species ranges from British Columbia to Lower California and far into Mexico.

**G. politus, new species.**

Similar in form to *nitidus* but smaller. Body entirely black, highly polished above, usually with distinct greenish tinge; rarely obscurely suffused with testaceous, especially toward the base of the elytra; legs and base of antennæ testaceous. Prothorax rather feebly narrowed posteriorly, the sides sinuate before the hind angles which are nearly right. Sides with a single marginal seta just before the apical third; basal impressions rather broad and with a few punctures. Elytral striæ except the sutural, faint or obliterated. Lower surface except the prosternal side pieces sparsely punctate, each puncture bearing a short hair; ventral surface finely but distinctly alutaceous, shining; pubescent spots in the male distinctly separated. Length 3.5 to 5 mm.

Oregon (The Dalles) to southern California. A rather common species which has hitherto been unaccountably confused with *nitidus*. It is evidently this species which Dr. Hamilton referred to as "the small form" in his Random Notes on Coleoptera (Ent. News, 1896, p. 291) where he says of *Tachycellus nitidus*, "Scarcely a species in the whole range of Coleoptera exhibits greater diversity among the individuals in size and color, varying from .14 to .28 inch in length and from bronzed black to testaceous. According to Dr. Horn the small form which is the black one is usually the male, while the larger testaceous individuals are mostly females." It is needless to say that the statement quoted is entirely misleading.

**G. intermedius, new species.**

Black, highly polished, with distinct bronze or green bronze surface lustre; base of antennæ and legs pale. Prothorax more distinctly narrowed behind than in *politus*, sides slightly sinuate before the hind angles, which are plainly obtuse though sharply defined; basal impressions with very few fine punctures. Otherwise nearly as in *politus*. Length 4.2–4.5 mm.

California. Described from three females, two of which (the types) were taken by me in the San Bernardino Mts., the third by Dr. Fenyès at Lake Tahoe. It is assumed in the table that the abdominal pubescent spots are as in *obtusus*.

**G. obtusus, new species.**

Differs from *intermedius* in its more obtuse hind angles of the prothorax, the side margins not or scarcely sinuate before them; also in the relatively shorter elytra, as indicated in the table. The abdominal pubescent spots in the male are contiguous. Length 3.5–4 mm.

Southern California (Pasadena, Azusa, Claremont). Our smallest species. Thus far it has been taken only in the valleys at elevations

of 1,000 feet more or less, while *intermedius* has occurred only at elevations of 5,000 to 7,000 feet in the Sierras.

The Harpaline genera of our fauna allied to *Tachycellus*, viz., those which have the terminal joint of the labial palpus equal to or longer than the preceding, and the penultimate joint bisetose in front, may be tabulated as below. The claims of *Trichocellus*, *Glycerius* and *Amerinus* to rank as distinct genera cannot be finally settled until a thorough study of the Harpali of both the Nearctic and Palearctic regions has been made. For the present their use will facilitate a clearer expression of the mutual relations of our own species and this in itself is a sufficient reason for their acceptance pending the broader study.

## TABLE OF GENERA.

Penultimate joint of anterior and middle tarsi of male bilobed, the middle tarsi dilated; prosternum plurisetose at tip; mentum not toothed..... **Stenolophus**.

Penultimate joint of anterior and middle tarsi simply emarginate, middle tarsi not or feebly dilated in the male (except *Tachycellus turbatus*).

Middle tarsi of ♂ biserially squamulose..... **Tachycellus**.

Middle tarsi of ♂ without, or with but few (*Amerinus*) squamules beneath.

Body beneath sparsely punctured and pubescent, prosternum plurisetose at tip, antennæ with three glabrous joints, males with pubescent spot or spots at base of abdomen.

Upper surface completely glabrous, sutural stria of the elytra alone impressed, the others feebly indicated or completely effaced; dorsal punctures wanting; thorax without seta in posterior angle.

**Glycerius.**

Upper surface with sparse fine pubescence; elytra normally striate with the usual single dorsal puncture, hind angles with setigerous puncture..... **Trichocellus**.

Body beneath glabrous and impunctate (except the prothorax in *Amerinus*). prosternum bisetose or non-setose at tip; antennæ with two glabrous joints, males without pubescent spot at base of abdomen.

Mentum toothed, elytra with a single dorsal puncture, prosternum non-setose at tip.

Middle tarsi of ♂ without trace of squamules beneath, tooth of mentum much shorter than the lateral lobes, elytra feebly sinuate at tip ..... **Bradycellus**.

Middle tarsi of ♂ with a few squamules beneath, tooth of mentum as long as the lateral lobes, elytra strongly sinuato-truncate at apex. .... **Amerinus**.

Mentum not toothed, elytra frequently with several dorsal punctures, prosternum either bisetose or non-setose at tip..... **Acupalpus**.

The number of setæ at the tip of the prosternum is a somewhat useful character, being constant throughout each genus except *Acu-*



*palpus*, and entirely independent of sex ; there is also, as in numerous other Carabide genera, some variation in the number of anal setigerous punctures. These variations are indicated categorically below :

**Stenolophus.** — Prosternum plurisetose at tip ; anal setæ variable. In the majority of species there are two each side in both sexes but in several species there is but one each side in the male.

**Tachycellus.** — Prosternum plurisetose at tip ; anal setæ one each side in the male and two in the female, except *turbatus*, in which there are two each side in both sexes.

**Glycerius.** — Prosternum plurisetose at tip ; anal setæ two each side in both sexes of *nitidus*, but in all the other species there is one each side in the male and two in the female.

**Trichocellus.** — Prosternum plurisetose ; anal setæ one each side in the male and two in the female. Our only representative is the common *cognatus*, widely dispersed over the northern part of both continents ; there are several allied species in Europe.

**Bradycellus.** — Prosternum without setæ ; anal setæ two each side in both sexes.

**Amerinus.** — Prosternal and anal setæ as in *Bradycellus* except that the interior anal setæ are not marginal.

Our only species is *Bradycellus linearis* of LeConte. The species is a very peculiar one and besides the tabular characters differs from all our species of *Bradycellus* in its relatively small eyes and long mandibles, sculpture, wider marginal bead of prothorax, the upper surface of which is deeply sculptured and the lower surface sparsely rather coarsely punctate.

**Acupalpus.** — Prosternum bisetose at tip in those species with several dorsal punctures on the elytra ; non-setose in those with a single dorsal puncture. Anal setæ one each side in the male and two in the female.

## THREE NEW SPECIES OF THE GENUS STATIRA LATREILLE.

BY CHARLES SCHAEFFER,

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Since Dr. Horn's synopsis of the family *Lagriidæ*\* a few additional species of the genus *Statira* have been taken in Arizona and Texas. One of them, *Statira robusta*, I have seen in collections as *opacicollis*, and *simulans* may easily be taken for *pluripunctata*; therefore I thought it advisable to publish the descriptions of these species together with Dr. Horn's synoptic table, which I was obliged to change a little to intercalate the new species.

### Genus *STATIRA* Latreille.

#### TABLE OF SPECIES.

1. Tibiæ sulcate on the outer edge.....	2
Tibiæ rounded on the outer edge, not sulcate .....	4
2. Setigerous punctures of alternate elytral intervals numerous, tibiæ sulcate nearly their entire length.....	3
Setigerous punctures few, mostly on the third interval, tibiæ sulcate below apical half only.....	<i>subnitida</i> .
3. Elytra subopaque, elytral striæ deeply impressed, punctures of striæ as large as the punctures of the intervals.....	<i>pluripunctata</i> .
Elytra shining, striæ moderately impressed, punctures of striæ smaller than those of intervals.....	<i>simulans</i> .
4. Elytra unicolorous, not ornamented with spots or fasciæ .....	5
Elytra testaceous with median fascia and scutellar spot black.....	10
5. Setigerous punctures numerous on first, third, fifth and seventh elytral intervals, thorax opaque .....	<i>opacicollis</i> .
Setigerous punctures entirely absent from first interval.....	6
6. Thorax bright orange red.....	9
Thorax more or less piceous.....	7
7. Only the third and fifth elytral intervals with setigerous punctures.....	8
Third, fifth and seventh elytral intervals with from six to ten setigerous punctures, elytra piceous, prothorax shining, indistinctly punctate.....	<i>robusta</i> .
8. Third and fifth elytral intervals with only a very few setigerous punctures; thorax indistinctly punctate; color piceous, with faint metallic lustre.	
	<i>gagatina</i> .

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\* Trans. Amer. Ent. Soc., vol. xv, p. 28.

Third and fifth elytral intervals with from six to ten setigerous punctures, thorax more visibly but finely punctate, elytra with distinct metallic blue lustre.

**basalis.**

9. Elytra blue, legs pale yellow ..... **croceicollis.**  
Elytra piceous with slight metallic lustre, legs yellowish to piceous.

**resplendens.**

10. Thorax orange, elytra reddish-testaceous with large scutellar spot, a fascia behind middle and suture more or less black..... **pulchella.**

**Statira simulans, new species.**

Reddish brown, elytra and abdomen piceous black, opaque, elytra shining. Antennæ half as long as the body, last joint as long as the three preceding. Head and thorax scabrous, the latter as long as broad, with the sides arcuate, sinuate near base, causing the hind angles to appear very prominent, lateral margin rounded. Elytral striæ closely punctate, intervals slightly convex, the first, third, fifth, seventh and ninth intervals with an irregular row of setigerous punctures, the latter generally larger than those of the striæ. Body beneath smooth and shining. Tibiæ on the outer edge sulcate from base to apex. Length 7-9 mm.

Brownsville, Texas. Four specimens in the Museum of the Brooklyn Institute.

This species is very similar to *pluripunctatus* but is a little more robust and always has the elytra shining, the setigerous punctures coarser, thorax shorter and broader and the antennal joints stouter.

All the specimens examined seem to be females. There is no difference in the position of the eyes, the length of the last antennal joint or in the general form.

**Statira robusta, new species.**

Piceous brown, head and underside piceous black, shining. Head sparsely punctate. Thorax as long as broad, arcuate in front, sinuate near base, lateral line distinct, surface shining and very finely punctate. Elytral striæ closely punctured, the third, fifth, seventh and ninth intervals with widely separated setigerous punctures. Body beneath smooth and shining. Tibiæ on the outer edge convex. Length 11 mm.

One female specimen from Globe, Arizona, which I owe to the kindness of Mr. Chas. Palm.

This species is larger and more robust than any of our known species; superficially it resembles the female of *opacicollis*, but the more robust form, the shorter and shining thorax and the absence of setigerous punctures on the first elytral interval readily separates it from that species.

**Statira pulchella Mäckl.**

I have taken a few specimens of this fine species by beating vine overgrown bushes in Brownsville, Texas. The color is orange yellow,

elytra slightly paler with a large scutellar spot, a transverse fascia slightly behind middle and wider at sides than at suture, black. The thorax is subopaque and distinctly punctured and the usual setigerous punctures on the alternate elytral intervals are nearly absent; the tibiæ are convex on the outer edge. In the Brownsville specimens the suture between the submedian fascia and apex of elytra is narrowly black and from the scutellar spot to the submedian fascia slightly infuscate, while the Mexican specimens seem to have the suture more heavily black; otherwise the specimens agree very well with the description.

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### Class I, HEXAPODA.

#### Order IV, DIPTERA.

## THE NORTH AMERICAN SPECIES OF CUTEREBRA.

BY MYRON H. SWENK,

LINCOLN, NEBR.

Recently, while working over the bot-flies in the collection of the University of Nebraska the writer found among them three species of the genus *Cuterebra* which appeared to be new. Descriptions of these are submitted below, and, in order to show their relationship to our other species and to facilitate their identification, the following table to all the species which have been described from the mainland of North America has been prepared.

Thorax above with the pubescence yellow (1).

Thorax above black, or with black pubescence (5).

1. Scutellum with black pubescence (Wash.).....*scutellaris* Brauer.
1. Scutellum with yellow pubescence (2).
2. A large bare black space on the anterior disc (Ga., Mass.).....*cuniculi* Clark.
2. No such bare space on thorax above (3).
  3. Last segment silvery, with yellow pubescence (Mexico) ..... *analis* Macquart.
  3. Last segment dark, with short black pubescence (4).
4. Abdomen blue-black (Ga., N. Y., Minn., Nova Scotia) .....*horripilum* Clark.
4. Abdomen reddish brown (Nebr.).....*abdominalis* Swenk.
  5. Pleura mostly yellow or white (6).
  5. Pleura wholly black (15).

6. Abdomen more or less pollinose or pale pubescent (7).
6. Abdomen entirely destitute of pollen or pale pubescence (14).
  7. Pleura with a cluster of black hairs above center (8).
  7. Pleura without a cluster of black hairs above the center, though sometimes with bare black spots (12).
8. Face and cheeks densely gray pollinose, each side of face marked with four polished streaks (Mexico).....**histrio** Coquillet.
8. Face white pollinose with a black spot on lower margin of eye and another midway between it and the mouth (9).
8. Face not marked as above (11).
  9. Front above antennæ on each side with three silvery pollinose spots arranged in a triangle, the two outer ones contiguous to the orbit (Fla., So. Car., Pa., Ky., N. J., Mass., Minn., Nova Scotia).....**buccata** (Fabricius).
  9. Front above antennæ with the two lower spots coalesced into a transverse line extending from the orbit almost to base of antennæ (10).
10. Second abdominal segment with a basal tuft of white hairs on each side (Wyo.) **albifrons** Swenk.
10. Second abdominal segment without such a tuft (N. M.).....**lepusculi** Townsend
11. Abdomen with three basal segments partly brown pollinose laterally, leaving bare spots, elsewhere steel-blue (Col., Wyo., N. M.).....**lepivora** Coquillet.
11. Abdomen with the fourth segment pollinose laterally (Ga., Ariz., N. M., Mexico).....**americana** (Fabricius).
12. Abdomen reddish brown, three last segments partly pollinose, with exposed spots (Cal.).....**latifrons** Coquillet.
12. Abdomen shining blue-black, only two last segments ever pollinose (13).
  13. Two last segments pollinose, with distinct bare spots (Ill., N. Y., Nova Scotia, Mexico) (= *emasculator* Fitch).....**fontinella** Clark.
  13. Penultimate segment with basal half whitish pubescent and with a few bare spots (Minn.).....**sterilator** Lugger.
  13. Penultimate segment, except apical margin, uniformly white pollinose and with long white hairs and no exposed spots, elsewhere entirely steel-blue (Nebr.).....**fasciata** Swenk.
14. Pleura with a cluster of black hairs above the center (Cal., N. M.) **nitida** Coquillet.
14. Pleura without a cluster of black hairs above the center (Wyo.) **polita** Coquillet.
15. Abdomen entirely destitute of pollen (Cal., Ore., Col., Wyo., S. D.) **tenebrosa** Coquillet.
15. Abdomen with the sides of the three basal segments white pollinose (16).
16. Last abdominal segment more or less pollinose (Mexico) (= *terrisona* Walker) **atrox** Clark.
16. Last abdominal segment entirely steel-blue, not pollinose (N. M.) **similis** Johnson.

**Cuterebra abdominalis, new species.**

♀. Very close to *C. horripilum*. Head dull black, tinged with brown about ocelli and on a large triangular elevated space on each side, clothed with short black hairs which are much shorter and fewer on the brownish areas. A brownish pollinose

spot is just above the center of each anterior eye margin and contiguous to it. Vertex at narrowest point five times as wide as distance between the posterior ocelli. Facial depression shining black, its extreme basal depth slightly silvery pollinose. Antennæ deep brown, the arista and its hairs black except at extreme apex. Below the facial depression and covering the area between the mouth and lower eye margins is a yellowish pollinosity, relieved by a black spot contiguous to the lower apex of each orbit, another much larger one between this spot and the mouth, and a black line which runs along each margin of the oral slit, widening to a spot posteriorly and connecting with the facial groove anteriorly. The area about the mouth is provided with long yellow hairs, especially posteriorly.

Thorax entirely covered with a long, very dense, brownish-yellow pubescence, longer in a tuft above the wings. Pleura similarly pubescent except for a large space above anterior coxæ which is merely yellowish pollinose with a large, exposed and bare, black spot. Wings brownish. Legs black, with short concolorous pubescence, the femora more or less white pollinose at base exteriorly. Abdomen reddish-brown, shaped as in *horripilum*, the two basal segments clothed dorsally with long brownish-yellow pubescence, denser laterally; elsewhere the pubescence is minute and black. All the segments (only slightly on the second) laterally and below with yellowish pollen relieved by numerous small exposed spots of the ground color. Length, 23 mm. Width of head at vertex, 9 mm.

Type: One female, Lincoln, Nebraska, June. (R. H. Wolcott.)  
Collection University of Nebraska.

In addition to the strikingly different coloration of the abdomen, the species differs from *C. horripilum* in the face marks as described and figured by Brauer, having but one orbital pollinose spot above, less silvery pollen in facial depression, a distinct black spot contiguous to lower margin of eye, etc.

#### ***Cuterebra albifrons*, new species.**

♀. Head dull bluish-black on vertex and upper portion of front, except for a brownish Y-shaped elevation surrounding ocelli and extending down the vertex, covered with short, scattered black hairs and a very minute and inconspicuous pale pubescence, the latter most noticeable just above the facial depression. Vertex at narrowest point five times as wide as distance between two posterior ocelli. On a level with the upper edge of the facial depression, and extending from the eye margins nearly to it are two transverse white pollinose bands, broadest at the orbits and extending in uniform width inward for one half their length, then by an abrupt incurving of the upper edge becoming a mere line and again abruptly widening into a subtriangular terminal knob. A short distance above these bands on each side is a small pollinose spot contiguous to the eye. On each side of the facial depression is a gourd-shaped black spot the neck of which connects narrowly with the black of the upper face, otherwise it is completely surrounded by a dense white pollinosity which covers almost the entire lower half of the face. The depression itself is white pollinose, without pubescence, and has a lanceolate black spot on each side of the lower margin. At the lower margin of the eye and contiguous to it is a black spot and between it and the

mouth is another slightly larger one. The pollinosity of the lower face extends behind the eyes to the vertex and is supplemented with a short white pubescence, for the most part thin but becoming long and dense around the margins of the cheeks and about the mouth, extending also upward from the mouth along the raised line to the facial depression. Antennæ with first two joints dark brown, the arista and its hairs blackish except on apical one third, which is pale.

Thorax above dark leaden bluish, without lustre, covered with a very short, thin, black pubescence, this becoming much longer and denser on the scutellum, which is fringed posteriorly with a short but very dense yellowish white fringe. Pleura and under surface of thorax with long, very dense, yellowish white pubescence, extending in a narrow fringe of short dense hair over the wings and along the margins of the thorax. A small tuft of black hairs is just above the center of the pleura, and two adjacent large bare spots are about midway between it and the anterior coxæ, on a pollinose spot bare of pubescence. Two similar spots are just above the intermediate coxæ, and on a similar pollinose spot. Just above the insertion of the posterior legs is a tuft of long black hair. Wings brownish hyaline.

Abdomen shining steel-blue, the basal segment bare, the second segment with a conspicuous tuft of white hair in each side near base, otherwise devoid of pubescence but with a white pollinose space on extreme sides, which is dotted with two or three small exposed dark spots. Following segments steel-blue dorsally but with lateral margins, especially at base, and entire under surface white pollinose, varied with numerous large, round, exposed steel-blue spots and a thin short black pubescence. Legs black, the femora brownish, with short black pubescence, the bases of the femora, especially on intermediate and posterior legs, whitish pollinose; on the posterior legs the femora have the basal half so, as well as the under surface of the tibiæ and the upper surface of the apical tarsal joints. Length, 19 mm. Width of head at vertex, 8.5 mm.

Type: One female specimen, Hecla, Wyoming (S. G. Clason).  
Collection University of Nebraska.

This species is closely allied to both *C. buccata* and *C. lepusculi*, but apparently differs from either by possessing the pale hair tufts on the second abdominal segment. The face marks, especially the superior pollinose spots, seem also to differ from either.

***Cuterebra fasciata*, new species.**

♂. Head black, slightly shiny, provided with very short, black hairs. A small triangular white pollinose spot is contiguous to the orbits on each side at upper level of facial depression, and another minute spot between it and the upper extremity of the depression, while still another is located contiguous to the anterior lower margin of each orbit. The extreme lower margin of the head between the eyes is white pollinose, but this is almost concealed by a long, very dense, white pubescence which forms a thick fringe, narrow laterally but widening medially to surround the mouth. The basins of the facial depression are pale silvery pollinose. Antennæ black, the apical two thirds of the arista and its hairs pale. Vertex at narrowest point three times the distance between two posterior ocelli.

Thorax above shining blue-black, clothed with short black hair, a line over the wings connecting with pleura and the pleura themselves covered with long, dense, matted, yellowish white pubescence, not varied with black spots. A dense black fringe around border of scutellum. Wings brownish hyaline. Legs black, shining, clothed with short black pubescence, not pollinose. Abdomen shining steel-blue, clothed with minute black hairs, not pollinose or pale pubescent except on penultimate segment which is, excepting the apical margin, uniformly white pollinose and clothed with long white hairs without exposed black spots. This white band extends over the entire segment and is very conspicuous and contrasting. Length, 16 mm. Width of head at vertex, 7 mm.

Type: One male, Lodgepole, Cheyenne county, Nebraska, July.  
Collection University of Nebraska.

A very distinct species belonging to the *fontinella* group.

***Cuterebra tenebrosa* Coquillett.**

The University collection contains a female from Hecla, Wyoming (S. G. Clason) and two males from Sheridan, Wyoming, taken August, 1900, which are referred to this species. They agree with Coquillett's description except in the face marks, for none of these specimens have any pollinose marks whatever on the face. This character, however, as the description intimates, is probably more or less variable in this species. Actual comparison with *tenebrosa* might show specific differences.

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## ILLUSTRATIONS OF THE ABDOMINAL APPENDAGES OF CERTAIN MOSQUITOES.

By HARRISON G. DYAR, A.M., PH.D.,

WASHINGTON, D. C.

(PLATE VIII.)

***Grabhamia mitchellæ* Dyar.** (Plate VIII, Fig. 1.)

Side piece elongate, outer lobe undeveloped, inner lobe small, setose; clasp moderately swollen centrally though not greatly inflated, with long terminal spine. Harpe jointed, basal part rather straight, uniform, apical filament long, as long as the basal part, uniform, scarcely tapered. Harpago smooth, curved, concave, the tip narrow and bent. Unci invisible. Appendage of the eighth segment small, setose.



**Grabhamia punctor Kirby.** (Plate VIII, Fig. 2.)

Side piece elongate, terminal hairs very stout ; outer lobe distinct, running basally to join the inner lobe, moderately setose ; inner lobe well developed, expanded, setose ; clasp filamentous with long terminal spine. Harpe jointed, basal part curved, uniform, outer filament broad, curved, not long, slightly recurved at tip. Harpago curved, concave, the tip narrow and bent. Unci invisible. Appendage of eighth segment short, broad, setose.

**Grabhamia abfitchii Felt.** (Plate VIII, Fig. 3.)

Side piece elongate, with stout hairs at apex ; outer lobe present, short, prominent, setose ; inner lobe well developed, long, running up to the outer lobe, setose throughout ; clasp filamentous with long terminal spine. Harpe jointed, uniform, the basal part curved, filament straight, equal in length to the basal part. Harpago smooth, elongate, curved, concave, the tip narrowed and bent. Unci invisible. Appendage of the eighth segment narrow, long, with few setæ.

**Grabhamia fitchii Felt & Young.** (Plate VIII, Fig. 4.)

Side piece elongate, with stout hairs at apex ; outer lobe present, short, prominent, setose ; inner lobe prominent, short, sharply conic, very densely haired ; clasp filamentous with long terminal spine. Harpe jointed, basal part straight, uniform, apical filament short, broad, with a notch at base with a slight prominence above it, the tip curved over. Harpago curved, concave, prominent, the tip narrow and curved. Unci invisible. Appendage of eighth segment distinct, broad, with many setæ.

**Culicelsa confirmatus Arrib.** (Plate VIII, Fig. 5.)

Side piece elongate, narrowed outwardly ; outer lobe present, elongate, smooth, an area at its base bearing numerous dense long hairs ; inner lobe small, setose, a broad stout spine arising near it which is bent at base and recurved at tip ; clasp filamentous with long terminal spine. Harpe jointed, the basal part long, even, the apical filament long, expanded, with a sharp retrorse branch near tip. Harpago elongate, conical, the tip tapered and bent. Unci invisible. Appendage of the eighth segment broad, setose.

**Anopheles crucians Wied.** (Plate VIII, Fig. 6.)

Side piece conic, stout, a lobe within near base bearing two stout setæ ; a second lobe within the first, conic, with triple stout apical setæ and two smaller ones on the basal slope. Clasp stout, long and broad, narrowed centrally, with a small terminal spine.

The species now known to be referable to *Grabhamia* may be separated on the following genitalic characters :

### SYNOPSIS OF SPECIES OF GRABHAMIA.

**Side piece without an outer lobe.**

Side piece without an inner lobe, a long row of cilia in its place.....**triseriatus.**

Side piece with a rounded, prominent inner lobe.

Inner lobe with long hairs surpassing the harpe.

Filament of harpe as long as basal part.....**varipalpus.**

Filament of harpe much shorter than basal part.....atropalpus.

Inner lobe with short hairs, not reaching the harpe.

Clasp filament hardly inflated .....**sollicitans.**

Clasp filament distinctly inflated..... **mittellæ.**

Side piece with the outer lobe developed.

Inner lobe of side piece with a long, stout spine.

Basal part of harpe simple..... { cantans.\*  
cantator.

Basal part of harpe with an angle or projection bearing a seta.

Inner lobe with two stout spines besides the basal one.....**impiger.**

Inner lobe without such spines.....**pullatus.**

Inner lobe of side piece without spines, setose only.

Outer lobe projecting, separate, the side piece subconical.

Filament of harpe about half as long as basal part.

Filament slender, pointed.....canadensis.

Filament broad, spathulate.....pretans.

Filament of harpe as long as the basal part.

Harpago broad, plate-like.....dupreei.

Harpago concave with acuminate bent tip.

Outer lobe projecting laterally.....**squamiger.**

Outer lobe projecting apically..... cúrriei.

Outer lobe continued along side piece to base, making the side piece broad and subquadrate.

Inner lobe normal, small, subprominent, with short hairs moderately dense

Basal part of harpe very long, nearly equalling the side piece in length.....trichurus.

Basal part of harpe less long, but still equalling half of the side  
piece ..... **lazarensis.**

Basal part of the harpe not equalling half of the side piece.

Filament of harpe broad, spatulate.....**punctor.**

Filament of harpe narrow, slender..... { *æstivalis*.†  
*trivittatus*.

Inner lobe not so formed.

\* The genitalia of *cantans* and *cantator* are alike.

† I have only Professor Smith's small figure of the genitalia of *trivittatus* and am unable to distinguish *æstivalis* therefrom.

- Filament of harpe slender, uniform .....**abfitchii**.  
 Filament of harpe broad, with a notch at base.....**fitchii**.

#### SYNOPSIS OF SPECIES OF *CULISELSA*.

Three species are now known to be referable to this genus. They separate as follows on genitalic characters.

Inner lobe of side piece broad and angled, but without a spine .....**tæniorhynchus**.  
 Inner lobe of side piece small, rounded, with a stout spine with hooked tip.

Side piece broad without .....**inconspicuus**.

Side piece narrowed without.....**confirmatus**.

The student will find a synopsis of genera of Culicidæ, based on genitalic characters in the Proceedings of the Entomological Society of Washington, vol. vii, pp. 42-49, 1905.

### Class I, HEXAPODA.

#### Order V, LEPIDOPTERA.

#### NEW SPECIES OF NOCTUIDÆ FOR 1905, NO. 3.

By JOHN B. SMITH, Sc.D.,

NEW BRUNSWICK, N. J.

##### ***Bryophila viridimedia*, new species.**

Head black, vertex snow white. Thorax deep wine brown, the tip of the collar a narrow dorsal line and the posterior tuft white. Primaries with basal space deep wine brown; this shade being limited by the t. a. line which crosses the cell squarely, one third from base, runs back along the median vein and crosses the submedian interspace one fourth from base, and again extends outwardly along vein 1, crossing to the outer margin one third from base, through the green of the median space which extends below vein 1 nearly to the base of the wing; forming a square black spot on the inner margin. The median space is bright, mossy green, crossed centrally by a deeper green median shade. The orbicular spot is round, broadly white-ringed and edged by a few black scales. The reniform is centrally constricted, hour-glass shape, broadly white-ringed, edged with blackish scales. Beyond the reniform a subquadrate black spot fills the space between it and the t. p. line. The t. p. line is composed of black lunules, followed by a narrow white line, its course as a whole an even outcurve. There is no obvious s. t. line, yet there is a shading that indicates a division of terminal and subterminal spaces. On the costa is an oblong deep brown patch extending from t. p. line to the point of the s. t. line, leaving the apex pale with a greenish overlay; below that is a violaceous shading which, on the inner margin forms a violet brown blotch just before the anal angle. Along the outer margin is a bronze

brown shading which extends inward at the middle and thus completes a mottling of the outer fourth of the wing. The fringes are solid deep brown. Secondaries soiled whitish, smoky outwardly. Beneath: primaries smoky, paler along costa where the inceptions of the lines of the upper surface are marked in blackish; apex pale; secondaries whitish, powdery along the costa, smoky at apex, with a narrow smoky extra-median line and a small discal lunule.

Expands: 1.20 inches = 30 mm.

*Habitat.* — Cochise county, Arizona, June 24.

One male in very good condition from Mr. George Franck. A very beautiful species and a distinct acquisition to our fauna. It may be that when a revision of this group is made that this species will not be placed in the typical genus.

#### Genus **ACRONYCTA** Ochsenheimer.

Since the publication of the Revision of this genus by Dr. Dyar and myself, considerable material has come to hand which has somewhat modified my opinion as to the standing of certain forms. Dr. William Barnes also was good enough to send me a large series for further comparison, which proves the distinctness of forms previously considered identical.

#### **Acronycta obscura** Hy. Edwards.

I have referred this as a synonym of *americana* but believe now that it is probably a good species. The material is scanty and, except for the fact that the range of variation is not so great as I concluded on a previous study, would not authorize changing the present status of the name. I have only a single example myself and know of no others except the types.

#### **Acronycta denvera**, new variety.

Closely allied to and probably a variety of *dactylina*. It differs in the more even, less powdery and somewhat creamy-tinted primaries which are really more nearly like those of *hastulifera*. The secondaries, however, are pale in both sexes and not much more powdered in the male than in the female. All the specimens, 2 males and 4 females, are from Denver, Colorado, and dated July, where they have any date at all. There is no difficulty whatever in separating the two forms where they are comparable in sufficient numbers.

#### **Acronycta eldora**, new species.

Belongs to the *americana* group and is a close ally of the typical species. The median lines are well defined, geminate, powdery, black rather than brown, the t. a.

line tending to become obscure. There is no basal streak, but the dagger mark is distinct in every specimen; usually it extends outwardly from the inner portion of the t. p. line; but it may be extended a little inwardly as well. The ordinary spots are of good size but tend to an irregularity in form, the orbicular becoming elongate to the extent of fusing with the reniform. The ground color of primaries is whitish gray, powdered with black scales so as to give an impression of thin scale covering, less marked in the female than in the male. Secondaries in the male are whitish with a diffuse extra-median dusky line; in the female with a fuscous or yellowish tinge.

Expands: 2.00–2.40 inches = 50–60 mm.

*Habitat*: Denver, Colorado, in July; Glenwood Springs, Colorado, July and August.

Eight examples in good condition and evenly divided as to sex. One pair is from Denver and were received years ago, probably from Mr. Bruce; the others are from Dr. Barnes. In 1898, with only one pair at hand, I believed this to be a local variation; comparing the specimens in Dr. Barnes' collection last spring he declared his belief that they were specifically distinct; a belief which I now share after closer comparison with additional material.

***Acronycta similana*, new species.**

Ground color a blackish powdery gray, like a dense black powdering over a whitish base. Orbits of the eye and base of antennæ white, head and disc of thorax otherwise the darkest portions of the insect. Primaries with a slender black basal streak, forking at the t. a. line which is indicated at the costa and on the inner margin. T. p. line continuous, lunulate in part, blackish, preceded by white shadings. Preceding the line in the submedian interspace is a more diffuse dark shading, through which a slender black streak crosses the t. p. line, forming a dagger mark. Fringes whitish, narrowly cut with blackish. Orbicular obscure, narrowly blackish ringed. Reniform a blackish blotch. Secondaries white with blackish sparse powderings, veins narrowly fuscous. Beneath, whitish with black powderings, each wing with a vague exterior line and a blackish discal spot.

Expands: 1.75 inches = 44 mm.

*Habitat*. — Chicago, Ill., June 15, Mr. A. Kwiat.

At first sight suggests a suffused *populi*; but the line of variation does not run that way in *Acronycta*, and though there is only one good male before me, Mr. Kwiat informs me that several others have been taken. I therefore prefer to consider this a good species at present.

***Acronycta sperata*, race *speratina*, new.**

A series of 10 males and 2 females from Colorado shows some interesting differences from the type, albeit none departs for a consid-

able distance beyond what we would consider typical. With only a few examples at hand a new species is indicated: with a good series the existence of a very distinct form is obvious, and this I have called *speratina*.

It is somewhat larger, more heavily built and, on the whole, paler, more ashen gray in color than the type: the maculation is more diffuse, less definite and altogether more obscure than is usual in eastern examples.

Expanse as in the type.

*Habitat*. — Denver, Colorado, in July; Dr. Barnes.

***Acronycta cæsarea*, new species.**

Head, thorax and primaries ashen gray, powdery, the dusting smoky olivaceous with a slight bronze lustre. Base of antenna with white scales and a white line at base of collar. Primaries with the median space a little paler than the rest of the wing, the markings fairly distinct, but the impression on the whole is one of uniformity. Basal line geminate, powdery, blackish, both portions equally defined. T. a. line geminate, black, the parts equally defined, included space broad, very even and outwardly oblique. The veins through the basal space are black marked and there is a little inward tooth from the middle of the t. a. line, but no basal streak or dash. T. p. line with a long outcurve over the cell and a well-marked incurve below; geminate, the inner portion smoky, partly lunate, the outer chiefly marked by the darker shade of the s. t. space, which, indeed, extends to the fringes. A vague s. t. line or shade is indicated by some irregular whitish blotches. Orbicular round, whitish with a dusky center. Reniform of good size, broadly kidney-shaped with a whitish spot and a central lunule. Secondaries uniform smoky, the veins a little darker; discal spot and shade of under side faintly visible. Beneath, primaries very dark smoky, somewhat blotchy; secondaries whitish, powdery along the costa, the veins blackish, a broken blackish outer band and a distinct discal spot.

Expands: .95 inches = 24 mm.

*Habitat*. — Essex County Park, N. J., May 20.

One good male from Mr. W. D. Kearfott. The species is smaller and narrower winged than *retardata*, which it otherwise resembles in a general way. The very uniform ashen gray and the small ordinary spots will further serve to distinguish the species.

***Aplectoides speciosa*, variety *arctica* Zetterstedt.**

Hampson, in his monographic work, makes "Ab. 2 *arctica*. Small and dark with the markings indistinct. Alpine and Arctic." I have seen alpine specimens that agree with this characterization; but have in hand now a male example from Mt. Rainer, Washington, which is very dark, almost blackish, the markings indistinct, but equals in size the typical form. Besides being indistinct, or better

indefinite, the markings are reduced and increased in contrast, the inclosed parts of the median lines and filling of the ordinary spots being white. The species is not common in collections at any time and the occurrence of this unusual form in a new locality is worthy of note; hitherto the species has not been recorded at all from the Pacific coast, so far as I am aware.

***Aplectoides arufa*, new species.**

Resembles in general appearance *A. imperita*, but has none of the reddish or brown shadings of that species and is altogether less marked. The ground color is a dull fuscous gray, the markings darker, emphasized by a few black scales only, and there are none of the contrasts that make the eastern species so recognizable. The median space is concolorous, the median shade is vaguely defined, and there are no black marks on the s. t. line; but the terminal lunules are large and distinct. The secondaries are smoky, whitish at base, with a broken terminal line, a dusky discal lunule and a smoky extra-median line.

Expands: 1.50 inches = 37 mm.

*Habitat.* — Yellowstone Park, Wyoming, in August.

One good male. The relationship to the eastern species is obvious; but so is also the difference. I have *imperita* from Labrador that are smaller with much more sharply defined markings than my example from Mt. Washington and, while the New Hampshire specimens differ among each other, none of them vary in the direction of *arufa*.

***Aplectoides fales*, new species.**

Head, thorax and primaries a rather even smoky gray, with a slight olivaceous tinge. Head and collar somewhat paler, with a slight reddish admixture. Dorsal tuftings of thorax with a brown shade; patagia well marked. Primaries without strong contrasts, all the maculation traceable, the ordinary spots and an area between reniform and s. t. line on costa more whitish. Basal line distinct, geminate, blackish, with whitish included space. T. a. line geminate, outer defining portion blackish, inner smoky; included space ashen gray; as a whole the line is outwardly oblique, a little curved, with small outcurves in the interspaces. T. p. line geminate, inner portion blackish to black, lunulated; outer portion obscure or smoky, crenulated, included space gray; as a whole the line has only a slight outcurve over the cell and only a very little incurve below it. S. t. line gray, a little irregular, preceded by a distinct black shade which becomes inwardly diffuse and is the most conspicuous portion of the wing. There is a slender, lunulate black terminal line. A vague median shade darkens the space between the ordinary spots and part of the outer portion of the median space. Claviform concolorous, small, pointed, narrowly black lined. Orbicular large, pale gray, not defined above, broadly V-shaped. Reniform moderate in size, kidney-shaped, gray, rather well defined by a narrow black line. Secondaries an even smoky gray, the fringes white. Beneath pale gray, powdery, both wings with smoky outer bands and smoky discal spots.

Expands : 1.42 inches = 35 mm.

*Habitat.* — Calgary, Alberta, July 2, '96.

Probably received from Mr. Dod though the specimen does not bear his label. It is a broad-winged form more like *imperita* than *pressa* and yet not unlike an obscurely marked *pressa*. I have hesitated long before describing it and do so now only because this may be really the male of the following species — *discolor* — despite the differences in wing form and maculation.

***Aplectoides discolor*, new species.**

Head, thorax and primaries very pale gray, almost white, powdered with black. Head immaculate, collar with a vague dusky line across the middle. Thorax powdery, patagia obscurely submargined. Primaries irregularly shaded and powdered, with conspicuous contrasts and varying greatly. Basal line geminate, marked on costa, blackish. T. a. line geminate, not well defined, as a whole outwardly oblique and with a little outcurve. T. p. line geminate, obscure, marked only by pale included space or by occasional smoky or blackish scales; as a whole a little outcurved over the cell and a little incurved below. S. t. line white, a little irregular, preceded by a more or less continuous black shade which becomes diffuse inwardly. A series of small black terminal lunules. An obscure median shade. Space before and between the ordinary spots is the darkest part of the wing, a black bar connecting the spots inferiorly. Claviform large and broad, incompletely outlined. Orbicular large, round or oval, black margined, center with or without a dark spot. Reniform moderate in size, kidney-shaped more or less completely outlined, the center powdered with blackish. Secondaries whitish with a smoky suffusion which forms an obscure submarginal band and discal lunule; the fringes white with a dusky line at base. Beneath gray, powdery, with a more or less obvious extra-median line and discal spot.

Expands : 1.55–1.65 inches = 39–41 mm.

*Habitat.* — British Columbia; Inverness, July 16; Mouth of Skeene River, June 29.

Two females received from Dr. James Fletcher, both somewhat defective and illustrating extremes in ornamentation. The ground is white in both cases: in one specimen the cell except for the ordinary spots is well darkened, but as for the rest the powdering is scant and scarce sufficient to mark any except the s. t. line; there is merely a vague mottling. In the second specimen the black is diffused over the entire wing and the ordinary lines are marked by the white included spaces. The wing form is like that of *pressa* and the paler specimen might at first be mistaken for that species or yet more easily for *condita*. Although *fales* may possibly prove to be the male of *discolor* it would be the first instance in this genus of a sexual difference in wing form.



***Rhizagrotis perolivalis*, new species.**

Head, thorax and primaries gray, overlaid by a dark olive. Head with white scales intermixed and with the lower half whitish. Collar whitish below a median black transverse line, and sometimes white tipped. An oblique white line on the patagia from the costal insertion of primaries to the anterior divided crest; edges of patagia also white in one specimen. Primaries with the costal region whitish to the t. p. line and the s. t. space with whitish powderings. Basal line distinct, white, with black scale edgings. T. a. line white filled, outwardly defined by a broad, somewhat diffuse black line, inwardly by a smoky line; in course almost upright to the submedian vein, outcurved in the interspaces, with a long outward bend below vein 1. T. p. line almost parallel with the outer margin; geminate, outer line incomplete, narrow, even; inner line narrow, a little crenulate, blackish, included space more or less whitish. S. t. line of the pale ground or whitish, preceded by black sagittate spots so arranged as to give the appearance of white rays on veins 3 and 4 and 6 and 7. A narrow black terminal line. There is a black edging below the median vein in the basal space. A yellow bar extends from the end of the claviform to the t. p. line. Claviform concolorous, narrow, rather elongate, edged with black. Orbicular narrow, oblique, black-edged, white filled. Reniform kidney-shaped, rather narrow, black-edged, whitish powdered. Secondaries pale smoky yellowish, outwardly darker, the fringes white. Beneath gray, powdery, especially toward the margins.

Expands: 1.36–1.40 inches = 34–35 mm.

*Habitat.* — Calgary, Alberta, head of Pine Creek, July 9, 10, 14.

One male and three females, all in good condition from Mr. F. H. Wolley Dod. The species has a close superficial resemblance to the *4-dentata* series of *Euxoa*, and with only the female at hand I associated it with *olivalis*. The receipt of the male and of additional females makes it possible to determine the genus in which the species has no close allies, superficially. It may be that *terrealis* which I referred to *Chorizagrotis* will eventually be associated with this species in *Rhizagrotis* or that because of the general agreement in type of maculation, *perolivalis* will go to *Chorizagrotis*.

***Noctua acarnea*, new species.**

Head and collar deep, almost purplish brown; collar with a blackish transverse line; disc and thorax more reddish, patagia almost carneau, and much brighter than any other part of the insect. Primaries very dark, almost blackish brown, with a purplish tinge, with a reddish shade in the upper portion of median space, most obvious in the reniform. Basal line geminate, broken, outer part of line blackish, inner obscure, included space reddish; as a whole, nearly upright. T. p. line obscurely geminate, irregular, with an even and not very marked outcurve. Inner part black-marked, emphasized by some reddish scales following. S. t. line somewhat irregular, reddish, punctiform, a little emphasized by darker shadings. Fringes concolorous. Claviform small, incompletely outlined, obscurely shaded with reddish.

Orbicular large, round, concolorous, edged by black scales and some reddish powderings. Reniform large, kidney-shaped, filled with reddish powderings; edged with black scales; the space between the spots somewhat darker. Secondaries dull, pale, smoky yellowish, tips of fringes paler. Beneath smoky gray, powdery.

Expands: 1.56 inches = 39 mm.

*Habitat.* — Banff, Alberta; N. B. Sanson, "Museum," July 11, 1902.

One good male, received through the courtesy of Dr. James Fletcher. The species is an obvious ally of *bicarnea*, with a similar excavation in outer margin of secondaries below apex; but it lacks the characteristic shadings and the details of maculation, especially in the ordinary spots, are quite distinct.

***Euxoa sotnia*, new species.**

Ground color very pale gray with a luteous tinge, densely powdered with black scales, especially in the female. Collar usually with a more or less obvious transverse line; but that is often wanting. Thoracic vestiture a mixture of fine and flattened hair, varying somewhat in proportion; the collar, patagia and crests well marked in good examples; but not prominent. Primaries rather narrow, elongate with the apex more reduced than usual; all the lines present, but broken and more or less obscured by the powdering. Basal line geminate, obscurely marked. T. a. line upright, or only a little oblique, a little outcurved in the interspaces; geminate, inner line tending to become lost, outer diffuse, more or less broken; sometimes the entire line hardly traceable. T. p. line geminate over costal region, abruptly bent over cells then very even to the inner margin, the inner line more or less diffuse, sometimes nearly even, sometimes lunulate and sometimes crenulate; but always traceable. S. t. line irregular, always traceable, variably distinct; sometimes defined by an even dusky terminal space; sometimes also by a preceding shade; occasionally only picked out by light scales. Apex usually concolorous, the inception of s. t. line on costa often preceded by a blackish shade. A series of terminal dots or small lunules is often present; but as often wanting. Fringes variable. There is a diffuse dusky median shade that darkens the cell between the ordinary spots, and then runs close to and parallel with t. p. line, often darkening the outer part of median space. This shade is variably developed but always recognizable in some form. Claviform wanting. Orbicular round, varying in size, rarely defined, sometimes concolorous; sometimes discolored; rarely with a dark center. Reniform of good size, kidney-shaped, never completely defined, sometimes scarcely traceable. Secondaries white, with a narrow dusky edging in the male: in the female they are sometimes equally immaculate; but the tendency is to a smoky outer border beyond an extra-median line, and sometimes a discal spot is also traceable. Beneath, more or less powdery, sometimes almost immaculate, ranging to forms in which the disc of primaries is blackish, and there is an obvious extra-median line on both wings.

Expands: 1.15–1.38 inches = 29–34 mm.

*Habitat.* — Stockton, Utah, September 9–24.

A series of eight males and nineteen females, mostly fair, from Mr. Tom Spalding. The species is variable as has been indicated in the description, and it has no very close allies. At first sight it looks like *alcesta*; but the median shade separates the two and the narrower, more pointed primaries are also characteristic.

***Euxoa alcesta*, new species.**

Ground color very light yellowish ash gray, sometimes with a faint reddish tinge, irregularly and rather sparsely powdered with coarse blackish atoms. Head and thorax concolorous, collar sometimes with a defined subapical line. Thoracic vestiture mostly flattened hair, collar and patagia not well defined, the crest obscure. Primaries with the lines all geminate, all broken and no contrasts. Basal line marked on costa and below median space. T. a. line a little oblique outwardly, only a little irregular; outer portion of line best marked. T. p. line with the outer line vague, inner more or less crenulate, course nearly parallel to outer margin. S. t. line pale, irregular, tending to form dents at its middle, marked by the uniformly darker terminal space and, sometimes, by a preceding dusky shade as well. There is a series of small black terminal lunules, followed by a yellowish line at base of fringes. Claviform wanting in all examples before me. Orbicular round, of moderate size, imperfectly defined, concolorous with ground. Reniform obscurely marked, apparently of good size and kidney-shaped. The cell between these spots is more or less darkened and sometimes even black. Secondaries white in the male, with a very narrow dusky edging. In the female the wings are a little soiled, and there is a tendency to an extra-median line. Beneath whitish, with a more or less obvious common line and a discal spot, both best marked on primaries.

Expands: 1.24-1.50 inches = 31-35 mm.

*Habitat*.—Stockton, Utah, Sept. 5-26.

Ten males and six females from Mr. Spalding, all in fair condition. There is not much variation save in the matter of powdering, which brings out a little more or less contrast, locally or generally. The relationship is in part to *candida* and in part to *pallipennis*; the former is more chunky and the marking is not well defined; the latter is even in color and does not have the powdery surface.

***Euxoa anacosta*, new species.**

Ground color ashen gray, with a brown tinge, which is more obvious in the male than in the female, and gives the prevailing shade of the male primaries. Head paler than the ground, immaculate or with an obscure frontal line. Collar concolorous with head and costal region inferiorly, this pale shade limited by a more or less obvious black line across the middle, the upper half concolorous with thorax. Thorax more or less mottled with smoky brown, differing in shade, not maculate, usually the darkest portion of the insect. Primaries with costa as pale as the palest part of the disk, but not contrasting. The terminal space is evenly smoky and the darkest part of the wing: a dusky shade extends through and a little below the cell, and some

cases the entire median space is darkened. There is a variably distinct basal black dash, always broken by the basal line and rarely extending to the t. a. line. Basal line geminate, marked on costa and below median vein only. T. a. line geminate, defining lines blackish, broken, outwardly oblique and outcurved in the interspaces. T. p. line geminate on costa, outer line lost over cell, inner line crenulate, tending to become lost in the male, outwardly bent on costa and then evenly oblique below. Apex pale, breaking the pale irregular s. t. line which is preceded by a variable number of black sagittate marks. A series of small black terminal lunules. Fringes concolorous, with a very narrow pale line at base. Claviform narrow, pointed, extending to the middle of the median space, outlined in black, the concolorous center sometimes very narrow. Orbicular varying from round, complete, to oblique, oval or oblong; closed or open on costa; white ringed, the ring edged with black scales, the center of the palest ground. Reniform of good size, kidney-shaped, white ringed, edged with black scales, center usually pale. Secondaries white with a narrow dusky edging in the male, thinly smoked in the female, darkening outwardly to the white fringes.

Expands: 1.20-1.50 inches = 30-37 mm.

*Habitat*.—Stockton, Utah, Sept. 20-25.

Eleven males and about eighty females, collected by Mr. Tom Spalding. The species resembles *segregata* and was separated from a mixed lot of over five hundred examples, all of which were believed to be one species. As compared with *segregata* the new species does not have the contrasting costa and collar, and the contrasts of the disc of primaries are lacking. Altogether this is a more quietly marked form in which the transverse maculation is much better developed. The contrast between the sexes is well marked and the male is altogether brighter than the female.

***Euxoa bialba*, new species.**

Head and thorax ranging in color from reddish gray to deep purplish brown, head sometimes paler, sometimes concolorous; collar usually with an obvious transverse black line, sometimes paler inferiorly. Primaries brown, variably overlaid by lilac gray, darker over costal region and in terminal space, ordinary spots brought into relief by the black filling between them. Basal space usually a little paler than the rest of the wing, basal line usually distinct, geminate. T. a. line geminate, black, the lines narrow, usually well defined, inner often wanting, only a little oblique, with three almost equal outcurves in the interspaces. T. p. line geminate on the costa, not well defined, and usually lost over the cell; sometimes traceable as a crenulate smoky line parallel with outer margin. S. t. line pale, narrow, a little irregular, marked by a preceding costal shade as against the pale apex, and below that by the usually darker terminal space. There is a narrow, somewhat lunulate blackish terminal line and a narrow yellow line at the base of the brownish fringes. Claviform narrow, short, rarely outlined, sometimes indicated by a few scales only. Orbicular large, round or oval, concolorous or paler, rarely dark centered, edged with black

scales. Reniform kidney-shaped, large, incompletely defined outward and inferiorly, concolorous or a little dusky below. The space between the spots always darker and sometimes black, contrasting. Secondaries white in the male, only a little smoky outwardly in the female. Beneath pale, powdery, primaries always darker and sometimes quite smoky, always with a discal spot and sometimes with a partial exterior line; secondaries usually powdery along the costa only, sometimes with a discal spot, not rarely uniformly whitish.

Expands: 1.12-1.40 inches = 28-35 mm.

*Habitat.* — Stockton, Utah, September 9 to October 2; Volga, South Dakota, without date.

Seven males and ten females; most of them more or less defective, from Mr. Tom Spalding and Mr. P. C. Truman. The species resembles *albipennis* and is a close ally. It differs in that the sexes are similar and the female is not darker than the male. It is more than probable that many of the western *albipennis* will be found referable to this species, and that the true *albipennis* with the darker female, = *nigripennis*, will be found to be an eastern and northeastern species.

***Euxoa zembla*, new species.**

Ground color a dull, luteous gray with white and blackish powderings. Head and thorax concolorous, varying as the amount of light and dark powdering varies, and sometimes forming obvious transverse lines on the collar. Primaries with all the maculation present but not distinct, everything seeming rather diffuse from the powderings. Basal line geminate, outer line broader and darker, on the whole outwardly oblique, outcurved in the interspaces, the curves unequal. T. p. line geminate on the costa, the outer line lost in the outcurve, inner line lunulate, the points being emphasized so that it sometimes is almost crenulate; rather abruptly bent on the costa and very evenly oblique from the outcurve to the inner margin. S. t. line pale, chiefly marked by the darker terminal space and sometimes by preceding shades or spots which become most obvious above the hind angle and opposite cell: sometimes veins 3 and 4 are a little indented, but that is a variable feature. There is a row of black terminal lunules, beyond which there is a pale line at base of fringes. A median shade-line darkens the space between the ordinary spots and then runs close to and parallel with the t. p. line; but that is a variable feature, and sometimes wanting. Claviform small, variable in form and in distinctness of outline, never contrasting. Orbicular varies from round to oval, sometimes complete, sometimes open above, with narrow black outline and a broader, more obvious whitish annulus; the center concolorous. Reniform of good size, kidney-shaped, a little oblique, defined like the orbicular. Secondaries in the male white, with a narrow dusky edge and the veins a little smoky; in the female usually a little smoky throughout, becoming darker outwardly, fringes white. Beneath powdery, primaries quite dusky, all wings with a discal spot.

Expands: 1.25-1.46 inches = 31-36 mm.

*Habitat.* — Stockton, Utah, Sept. 4-22.

Four males and nineteen females, mostly in good condition, from Mr. Tom Spalding. This species reminds one somewhat of *pleuritica* and belongs in the same group. The antennæ are rather broadly fringed in the male and the primaries are rather narrow, with somewhat marked apices.

***Fishia betsia*, new species.**

Head, thorax and primaries bright ashen gray with fine black powderings which give it a slightly bluish tinge. Collar with a black median line. Patagia with a distinct black line at base of wings and an obscure darker margin along the disk. Primaries with a black basal streak, sharply defined above, a little diffuse below, which extends well into the median tooth of the t. a. line. T. a. line single, black, broken, slender, with three long outward teeth, the first of which touches the orbicular, the second meets an inward tooth of the t. p. line and the third, least marked of all, reaches the middle of the median space. The t. p. line is vaguely indicated by a paler shading only until opposite the cell; then a series of black interspaceal streaks and a few black scales indicate the presence of the line to vein 2, below which there is a distinct black inward tooth which meets the t. a. line. There is a series of black terminal lunules at the base of the interlined fringes. Claviform concolorous with a fine black outline, extending above the median tooth of the t. a. line to the t. p. line. Orbicular large, oblique, a little paler than the ground, bordered by black scales at its anterior margin only. Reniform upright, oval, of moderate size, a little paler than the ground, very ill defined. Secondaries white, the veins a little dusky, with a series of blackish terminal lunules and a reflected round discal spot. Beneath whitish, with gray powderings; both wings with a round discal spot of moderate size.

Expands: 1.50 inches = 37.5 mm.

*Habitat*. — Stockton, Utah, October 4, 1904, Spalding.

One male in good condition; the female will probably be found to be larger, darker, with better defined maculation. The species differs from all those heretofore described by the very light ashen gray primaries and clear white secondaries. *Exhilarata*, its nearest ally, is distinctly darker and with heavier markings. I have seen a female collected by Mr. Spalding, October 6, 1903, which agrees in all respects with ♀ *vinela*, the ♂ of which bears no resemblance to the new form.

***Mamestra tufa*, new species.**

Ground color bluish pale gray with slight brownish tintings. Head with a frontal line, collar with a median band, disc of thorax powdery, without obvious markings. Primaries narrow, elongate, pointed, the outer margin notched. All the transverse maculation except s. t. line broken, obscure, though the course of the strongly angled t. a. line can be made out in part. S. t. line whitish, broken, very close to outer margin which is reached by the w on veins 3 and 4, preceded by blackish brown shadings which are most obvious opposite the cell and above anal angle.

There is an obscure black line, broken into scales through the submedian interspace, best marked at base. The ordinary spots are fused inferiorly, the lower and outer margin of the combined spot shaded with deep brown, the upper and inner tending to obsolescence. As a whole the wings look strigate without actually being so. Secondaries white. Beneath white, with a little blackish powdering, most obvious on primaries.

Expands: 1.55-1.60 inches = 39-40 mm.

*Habitat.* — Stockton, Utah, August 30.

Two male examples, neither of them very good, collected by Mr. Tom Spalding. One of them, from Dr. Barnes, is labelled '02; the other, from my own material, is labelled '04; the inference is that the species is not common. This species is an ally of *nugatis* and the smallest of the *purpurissata* type. It is an exaggeration of the *juncimacula* style of maculation and agrees with *nugatis* in the white secondaries. The yet narrower primaries, much lighter bluish gray color and the differences in details distinguish it from the latter species.

***Mamestra agnata*, new species.**

Ground color a rather uniform ashen gray, a little darker in the female than in the male. Collar with a distinct black cross-line, patagia with black submargin. Primaries with all the lines and marks cleanly defined and complete, yet nothing contrasting except a lunule in the s. t. line above the anal angle, which is white and relieved by a preceding blackish shade. Basal line geminate, blackish, irregular. T. a. line geminate, outer portion usually more obvious, a little outcurved, even or a little outcurved in the intervals. T. p. line almost evenly bisinuate, inner line broader and barely lunulate. S. t. line whitish, making two rather even outward curves with an angle between them, emphasized by a dusky following shade and in the s. m. interspace as already described. A black, scarcely lunate terminal line. A yellow fine line at the base of the long fringes which are cut with blackish. There is a median shade which darkens the space between the ordinary spots and extends below to the inner margin. Claviform moderate or small, black margined, and beyond and partly over it is a reddish brown shading, the only patch of color in the wing, and that not always present. Orbicular moderate or large, round or a little irregular, black edged, annulate with pale gray, center concolorous or nearly so. Reniform upright, of good size, black margined, with a pale interior ring, and the disc paler than the ground, but not contrasting. Secondaries a little smoky in the ♂, decidedly so in the ♀; even in both cases. Beneath, gray, powdery, darker in the female, a common extra-median line and on the secondaries a discal spot.

Expands: 1.25-1.35 inches = 31-34 mm.

*Habitat.* — Redington, Arizona.

Three males and two females from Dr. Barnes, all in good condition and all without date. This species has the antennæ in the ♂ marked and bristle tufted, and is an ally of *M. gnata* Grt., which

occurs in the same faunal region. It differs materially, however, in the clearly written maculation and in the entire absence of the color characters of Mr. Grote's species.

**Mamestra basiplaga, new species.**

Dull fuscous brown, powdered and suffused with blackish. Head and collar paler, more reddish; head with a median cross line, collar with a black band at about middle, above which it is often of the darkest thoracic shade. Disc of thorax varies from a brown mottling to a blackish purple. Primaries with the upper half of basal space and the s. t. space generally, shaded or suffused with reddish brown in the male, this verging toward lilacinous toward the inner margin. Basal line geminate, obscure, usually traceable to a black longitudinal streak which extends almost to the t. a. line and is obvious in most specimens. Another black streak along inner margin at base, seems to be less constant. T. a. line geminate, inner line obscure, outer blackish, as a whole very irregular in course, nearly upright. T. p. line geminate, obscure through the brown area beyond the reniform, distinctly though not strongly incurved in the s. m. interspace. S. t. line irregular, broken, whitish, partly defined by the dark terminal space and in part by the preceding smoky blotches. A black line at base of fringes, which are cut with yellowish-brown. Claviform broad, rather short, triangular, concolorous, defined by a black outline, a black line generally extending from it to the t. p. line. Orbicular round or oval, usually pale ringed; but this varies greatly as does also the filling. Reniform small, oval, narrow, oblique, outer portion always white lined, usually edged with black scales, so that the outer margin stands out by contrast. Secondaries in the ♂ whitish at base, becoming dusky toward outer margin at apex; in the ♀ smoky fuscous throughout except at extreme base. Beneath, primaries smoky, darkest in the ♀; secondaries whitish, powdery along the costal area, with a discal spot.

Expands: 1.12-1.16 inches = 28-29 mm.

*Habitat.* — Huachuca Mts., and Southern Arizona, Poling.

Three males and six females, all from Dr. Barnes. No two are alike, and yet all have a similarity of habitus that brings them together. The general reference is to the *vicina* series, which the male genitalia seem to bear out from such examination as I could make of the specimens.

**Mamestra imbuna, new species.**

Dark ashen gray, head and lower half of collar often with a reddish tint, primaries with usually a reddish flush beyond the reniform. A distinct black line below the apex of collar. Patagia more or less obviously submargined with black. Primaries with a short curved black streak at base, above which the wing is usually a little lighter. T. a. line rather well removed from base; geminate, even, the outer line best marked, included space gray, as a whole with an oblique outcurve. T. p. line geminate, slender, the inner portion blackish, included space narrowly gray, outer portion often lost; as a whole even, with a wide bend over cell and a marked constriction in the submedian interspace. S. t. line irregular, broken, preceded by



variably defined dusky spots and sometimes by darker shades; just before the anal angle rather prominently marked by white scales. There is a narrow black line at the base of the fringes which are dark and narrowly cut with yellowish. Claviform large, conical, black-ringed, extending across the median space, the apex on the t. p. line. Orbicular large, irregular, oblique, black-ringed, the center concolorous or a little paler, the anterior margin resting on the t. a. line or connected with it by a black shading. Reniform large, extending above and below the cell, rather narrowly kidney-shaped, both ends resting on the t. p. line. Secondaries in the male whitish, becoming blackish at the margins; in the females more evenly smoky as a rule. Beneath primaries dark smoky brown, powdery; secondaries whitish in the male, darker in the female, powdery, with an outer line which in the female tends to become the inner margin of a distinct dark border.

Expands: 1.20–1.34 inches = 30–34 mm.

*Habitat.* — Lucerne County, Pennsylvania, in April; Hessville, Indiana, August 14.

Four males and 4 females in fair condition are at hand. Seven of the examples were received from Mr. George Franck and the females are uniformly darker and have the primaries broader than the male. The eighth specimen is a female, received from Mr. Kwiat, which is in all respects like the Pennsylvania males and shows none of the color differences above noted. The species is allied to *vicina* in wing-form and has a well marked excision below the apex of secondaries.

***Mamestra uliginosa*, new species.**

Dull blackish brown to blackish, powdered and marked with white. Head and thorax more gray, powdery, head with one or two transverse darker lines; collar with a black median line; patagia with dark margins. Primaries with the maculation all present and more or less relieved. The ordinary spots whitish, more or less contrasting, and form the most obvious features. Orbicular round, moderate in size, with a central dusky spot. Reniform large, broad, upright, oblong, a little constricted in center, more or less mottled. Basal and s. t. spaces more or less mottled, median space more uniform. Basal line geminate, blackish, filled with whitish scales. T. a. line geminate, outwardly oblique, only a little curved or waved, intervening space more or less powdered but not filled with white. T. p. line makes a rather even and irregular bend over the cell and a little incurve below: it is more or less white-marked but not distinct and tends to become obscure. S. t. line irregular, broken, composed of white scales and not defined. The claviform is black-margined, concolorous, of moderate size, and in no way relieved. Secondaries in the male white, in the female muddy or smoky, with a tendency to yellowish; fringes white. Beneath, powdery; almost white in the male, dull smoky gray in the female; primaries darker in each case, secondaries in the female tending to an outer line and discal spot.

Expands: 1–1.20 inches = 25–30 mm.

*Habitat.* — Southern Arizona, Poling; Kerrville, Texas, Dr. Barnes.

Two males and three females in good or fair condition, none of them dated. The sexual difference is well marked in this species, which is allied to but not of the *olivacea* series. It is a more obscure form, and the tendency seems to be rather to a blackish base on which the ornamentation is picked out with white scales.

***Leucania ferricola*, new species.**

Ground color of head, thorax and primaries a thin rusty red over creamy yellow. Head and thorax more rusty, apparently immaculate; but the thoracic vestiture is compressed and so a little obscured. The primaries have the *albilinia* type of maculation. There is a distinct pale s. t. line which does not extend to the costa, and beyond that the terminal space is bluish; this tint running out to a point below the apex. There is a series of black terminal lunules and beyond it a brown line at the base of the fringes. A brown shade in the cell starts at basal fourth and widening, fills it, including the small black reniform and extending to the s. t. line. There is a short black streak from base along the median vein. There is a black shading below the submedian at base, changing to a brown which reaches the s. t. line; the brown shade limited above by a black streak through the middle of the submedian interspace. There are black dashes in brown clouds in the interspaces before the s. t. line. Secondaries pale with a reddish tinge, a narrow dusky terminal line and a dusky discal spot. Beneath, distinctly yellowish; the costal margins powdered with brick red, and each wing with a small blackish discal spot.

Expands: 1.12 inches = 28 mm.

*Habitat*. — Cochise County, Arizona, in July.

One male in very good condition except for the crushed thorax, from Mr. George Franck. The species is the most brilliant of those belonging to this series and has every detail of the maculation perfectly defined.

***Luperina extensa*, new species.**

Head, thorax and primaries dull brown, with a somewhat luteous tinge as a base. Palpi, head in front and base of collar a little more yellowish in tinge. Abdomen a little lighter, more yellowish. Primaries with the transverse maculation tending to obsolescence. There is a yellow streak through the submedian interspace that extends from base, where it is inferiorly marked by black scales across the t. p. line, and is lost just before the s. t. line. This streak is not contrasting, though perfectly distinct, and the edges are a little diffuse. There is a black streak along inner margin at base. Basal line lost. T. a. line obscurely indicated by blackish scales in the paler parts of the wing. T. p. line single, obscure, darker brown except toward the inner margin where it is emphasized by black scales; somewhat relieved by following yellow scales, its course as a whole a little outcurved over the cell and only a little incurved toward inner margin. S. t. line a little irregular, broken, made up of yellow scales, preceded and followed by black scale shadings, so that the line is clearly distinguishable throughout its course. A series of distinct blackish terminal lunules. Fringes yellowish. Claviform not marked in the specimen. Orbicular

narrow elongate, oblique, edged by black scales. Reniform narrowly kidney-shaped, upright, somewhat dilated inferiorly, yellowish, more or less black-edged. Secondaries washed with dull yellow, the outer border darker, smoky; fringes pale. Beneath, primaries smoky with a silky lustre; secondaries powdery whitish yellow, with apex and costal margin darker; a punctiform extra-median line and a discal dot.

Expands: 1.44 inches = 36 mm.

*Habitat.* — Regina, July 28, at light; T. N. Willing.

One male, in fair condition, secured through the kindness of Dr. James Fletcher. The species has the characteristic appearance of members of this genus and is perhaps closer to my *trigona* than any other. The yellowish longitudinal streak and the narrow, yellow ordinary spots are characteristic.

***Perigea flavistriga*, new species.**

Head, pale red-brown, darkening to the vertex. Thorax dark brown, almost blackish, base and tip of collar and margins of patagia more reddish. Primaries dark smoky brown, almost blackish, powdery, so that nothing is defined, though all the usual lines and markings can be made out. Basal line marked by a geminate black spot on costa only. T. a. line incomplete, marked on the costa and by a black outcurve in the submedian interspace, otherwise hardly traceable. The basal space is somewhat yellow mottled and a distinct yellow streak extends beneath the submedian vein by the t. p. line. T. p. line geminate, the outer line obscure, the inner narrow, lunulate, blackish, emphasized by a yellow powdering which follows it, well curved over the cell and very oblique and even to near the middle of hinder margin. S. t. space is a trifle paler to the s. t. line which is irregular, made up of yellow scales, defined by vague black preceding spots and a generally darker terminal space. There is a broken black terminal line. Claviform not traceable in the specimen. Orbicular narrow, oblong, oblique, incompletely margined with yellow scales, a little paler than the ground. Reniform large, kidney-shaped, incompletely ringed with yellowish, which tinges also the middle of the mark itself. Secondaries smoky; paler, more yellowish at the base and with an obscure discal lunule. Beneath, primaries smoky brown, immaculate; secondaries dull, smoky yellowish, with a smoky outer line and discal lunule.

Expands: 1.32 inches = 33 mm.

*Habitat.* — Lethbridge, Alberta, July 11; T. N. Willing.

A single female in good condition, from Mr. F. H. Wolley Dod (No. 8). It is a robust species with narrow obtusely rounded primaries, the thoracic vestiture flattened hair rather than scales. It belongs with *texana* in general appearance and habitus.

The yellow streak is the most obvious characteristic of this species, which is otherwise powdery and obscurely marked.

***Crambodes abalas*, new species.**

Ground color a powdery, dull reddish luteus. Head with white and metallic gray powderings. Thorax with metallic gray powderings, collar and patagia well defined, posterior tuft well marked. Primaries with all the maculation obscure; costa except apex, fringes and most of the median space smoky brown, not strongly contrasting. T. a. line widely outcurved, most obviously so in the submedian interspace. T. p. line outcurved over the cell, incurved below; both lines indefinite. There is a series of black terminal lunules between which the broad dark fringes are cut with the ground color. Orbicular a vague, indefinite small spot of the ground color. Reniform a similarly indefinite lunule. Secondaries soiled whitish, a little darker toward the outer margin; fringes paler. Beneath soiled whitish, a little smoky on the primaries, powdery, with a smoky longitudinal shading from base to middle of wing.

Expands: .88–1.04 inches = 22–26 mm.

*Habitat*. — Cochise County, Arizona, in July.

One male and five females, in fair condition only, from Mr. George Franck. The species is smaller than and quite obviously distinct from our northern species and has more the appearance of *Hadenella pergentilis*, as well as its tuftings. It seems safely referable to *Crambodes*, however.

***Orrhodia insinuata*, new species.**

Ground color of head, thorax and primaries dull fuscous brown, overlaid with blackish. Head and thorax immaculate, vestiture loose, somewhat shaggy, thoracic parts not well defined. Primaries with the markings barely traceable and no contrasts of any kind. T. a. line outwardly oblique with moderate outcurves in the interspaces; barely traceable by a slightly darker shading. T. p. line with an even, small outcurve over the cell, and a very slight incurve below; traceable as a very narrow paler line or rather of the ground color free from powderings. S. t. line badly indicated by a slightly paler shading. Orbicular round, of moderate size, with a slightly paler annulus. Reniform, upright, large, a little constricted centrally, slightly darker than the ground. Secondaries a little paler and with thinner scaling than the primaries. Beneath paler than above, with an obscure outer line and on secondaries an obvious discal spot.

Expands: 1.25–1.35 inches = 31–34 mm.

*Habitat*. — Pullman, Washington, May 8 and 9.

Four examples, all females, in tolerably good condition. The species is congeneric with my *Orrhodia californica* and has the same type of markings so far as any can be distinguished. It is only with a glass, however, and with a knowledge of what is sought that they can be made out at all. The species is more loosely clothed than the typical forms and raises the question whether the generic reference may not have to be changed eventually. The specimens do not have

Professor Piper's label, and are, I believe, a part of a lot received subsequent to his removal from Washington.

***Xylina atincta*, new species.**

Ground color dull ashen gray without any greenish or mossy tinge. Antennæ whitish at base. Collar with a subapical black line, a narrow dark line on patagia basing the wings. Primaries with the upper half of basal space whitish, hardly contrasting, the orbicular white or whitish, nearly always contrasting, the reniform with a faint reddish tinge, a trace of which also occurs before the t. a. line on some specimens. There is a slender black basal streak which curves upward and does not reach much if any beyond the middle of the basal space. Basal line geminate, indicated on the costa only. T. a. line geminate, outer portion a little darker and thicker, as a whole a little oblique and outcurved on the interspaces. T. p. line irregular, well curved over the reniform, abruptly bent in below it; geminate broken, inner line more or less lunulate, outer obscure. S. t. line paler than outer margin, preceded by a variably distinct dusky shade, which tends to become broken into spots. There is a series of distinct interspaceal terminal lunules. Median shade obvious in most specimens, crossing obliquely beyond the middle and outwardly diffuse. Claviform small, concolorous, obscurely outlined, scarcely traceable in some cases. Orbicular of good size, narrow, oblique, a little constricted centrally, narrowly black ringed, usually pale filled so as to be contrasting, but sometimes almost concolorous. Reniform large, broadly kidney-shaped, inner margin a narrow black line, outer border gray; the center is obscurely dark and shaded with a more or less obvious reddish tint. Secondaries smoky with a slight tendency to reddish, the fringes paler. Beneath, primaries dark smoky with costal and outer margin reddish gray and powdery; secondaries reddish gray, powdery, with a distinct smoky extra-median line and a well defined discal spot.

Expands: 1.44-1.58 inches = 36-39 mm.

*Habitat*. — Cartwright, Manitoba in September.

Three males and six females all from Mr. Geo. J. Keller, of Newark, who received them from a correspondent unknown to me. The species is not represented in the material sent me by Mr. Heath, nor have I had it from any correspondent in that region. I have a specimen from the mountains of western Pennsylvania that seems to belong here and is probably conspecific. The species resembles *tepida* but is not so well marked and lacks the contrasts of that species.

***Cucullia arizona*, new species.**

Ground color dark bluish ash gray, with the maculation smoky and black, sharply defined. Head deep blackish brown, crossed by black and gray lines. Collar gray, with three blackish and two white transverse lines. Dorsum of thorax black powdered; distorted by pressure and therefore not definitely describable. Primaries with maculation intermediate between *convexipennis* and *montana*. From the middle of the costa to the outer margin below the apex a paler gray shade extends, leaving the apical space darker than the rest of the wing and relieving the black scale

dots that indicate the margins of the ordinary spots. Below this pale shading is a dark edging that becomes blackish outwardly. Along the inner border a black shading extends to the middle, then expands and extends through the submedian interspace to the outer margin above the apex, cut by a narrow curved gray line indicating the position of the t. p. line. There is a slender basal black line and around it, extending to the middle of the wing, is the long outward tooth of the t. a. line. Secondaries whitish at base, shading into a broad, almost blackish outer band; veins blackish; fringes white. Beneath, primaries evenly blackish; secondaries much as above.

Expands: 1.80 inches = 45 mm.

*Habitat.* — Cochise County, Arizona in July.

One female specimen, in good condition except for the compressed thorax due to paperying; from Mr. George Franck. The wing form is as in *convexipennis*, and though the color is totally different, that species is at once recalled by the pale shading from costa to the outer margin.

#### Genus CONOCHARES, new.

Has the habitus of an *Acontia* but with somewhat more pointed primaries. Accessory cell of primaries absent in all specimens examined and the genus is therefore allied to *Thalpochares*. It differs by having the front conically produced, abruptly cut off, and the protuberance with a narrow, elevated rim. The genus therefore bears about the same relation to *Thalpochares* that *Conacontia* does to *Acontia*.

The occurrence of four species with apparently similar structure has persuaded me to propose the above generic term, although the forms already described in allied genera are not well-known and collections are scarce.

All the species are from the desert regions of Arizona and adjacent California; and as in so many forms occurring there, the protuberant front is characteristic, and may be indicative of habit. Two of the species have a superficial resemblance to *Acontia arizonæ* in wing form and type of maculation. The others, while similar, yet resemble the true *Thalpochares* more closely.

#### *Conochares acutus*, new species.

Head, thorax and primaries to the middle, white, immaculate. Beyond the wing is gray, more or less white mottled, the white s. t. line obvious, sinuate, the t. p. line more or less obviously marked, curved over cell, and incurved below. There is a series of black terminal marks and the fringes are white. At the inner border of the gray shading, the white base intrudes an acute tooth in the cell, extending to the round, gray, white ringed reniform. Secondaries blackish, fringes white. Beneath, primaries blackish, secondaries white.

Expands: .85-.90 inch = 21-22 mm.

*Habitat.* — Santa Catalina Mts., April 8-15; southern Arizona, May 15.

Two males from Dr. Barnes, one female from Mr. Poling; one of the males defective, yet representative in maculation. The leaden gray primaries with the acute outward indentation in the cell is characteristic.

***Conochoares interruptus*, new species.**

Head, thorax and basal half of primaries white, immaculate. Beyond the termination of the white area, at or a little beyond the middle of the wing, the surface is mottled with olivaceous gray, a little tinged with yellowish in some examples. The margin between the white and gray is sharply defined by a blackish gray line which diffuses outwardly, is oblique in general course, and is usually interrupted opposite reniform, the white extending to that spot which is round, gray, and ringed with white. The s. t. space is more or less mottled with gray and white, the pale s. t. line being always well-defined and a little sinuated. Terminal space gray or mottled. A series of small black terminal dots in some specimens. Fringes white, interrupted by a gray shading opposite cell and sometimes by another at hind angle. Secondaries slightly infuscated, darker outwardly. Beneath, primaries dull yellowish to smoky, secondaries white.

Expands: .80-.87 inches = 20-22 mm.

*Habitat.* — Southern Arizona, April 10, Poling; Phoenix, Arizona, March 12, Griffith; Yuma County, Arizona, in March, Hutson; Argus Mts., California, April, Koebele; Walters Station, California, April, Hutson.

One male and seven females, most of them in rather good condition. Five scattered localities for eight examples, taken by four collectors, argues rather a rare species; but I believe it will be found not uncommon when carefully sought for. As compared with *acutus*, this species is a little smaller, the outer half of wing is distinctly more mottled and with a luteous shading, the dividing line between colors is very even and the fringes are interrupted by gray shadings.

***Acontia dimidata*, new species.**

Head, collar, and anterior portion of thorax gray; remainder of thorax white; abdomen whitish. Primaries white to the middle, where the space is sharply limited by a blackish gray shading which is a little curved and somewhat irregular at the edge. Toward base, the white is irregularly interrupted by gray shadings on the costal region. In the dark portion of the wing there is a mottling of black and whitish scales, and with a lens the maculation can be picked out; but there is nothing clear except a white edging just before the fringes which are based by black scales. Orbicular wanting, reniform barely indicated. Secondaries a little dusky. Beneath whitish.

Expands: .58-.64 inches = 15-16 mm.

*Habitat*.—Redington, Arizona.

One male and one female from Dr. Barnes; both in good condition. There is nothing just like this species, and its associates are *sedata* and its allies.

***Acontia pima*, new species.**

Head, collar and thorax to the origin of the secondaries, white; behind that bluish or steel gray with metallic reflections. Primaries with costal region white to the s. t. line, upper half of cell white to the reniform, interrupted by a little jog at place for orbicular; beyond the reniform the white continues from the upper border of that spot which is upright, oval, small and marked in outline by black scales. Below the white and in the terminal space the wing is gray, overlaid by olivaceous scales with some iridescent blue and violet intermingled. The violet scales form vague lines, indicating the t. a., t. p. and median lines. The s. t. line is indicated by scattered white and bluish scales to the hind angle, above which a curved white line becomes distinct. There is a series of velvety black terminal marks. The olivaceous gray fringes are cut just above vein 2 by a broad white bar, which reaches to or nearly to vein 4. Secondaries whitish, with a dusky outer border. Beneath, maculation of upper side vaguely duplicated.

Expands: .95-1.00 inch = 24-25 mm.

*Habitat*.—Babaquivera Mts., Pima County, Arizona.

Two good males from Dr. Barnes, collected by Mr. Poling. The species is allied to *expolita* from the same region; but is larger, whiter, has half the thorax white and the hind angle of the primaries gray.

***Acontia aniluna*, new species.**

Head, thorax and anterior half of thorax white; posterior portion of thorax including tips of patagia shining slate gray. Primaries slate gray with three large white marks on costa, a white mark below the middle of fringes, and a white lunulate mark above anal angle. Of the costal marks that at base is usually trigonate, but may become oblong; the second is near the middle, is oblong and oblique, like a short band, and abruptly ended; the third is within the apex and more or less triangular with rounded tip, in all specimens. The white cut in the fringe may be narrow, may include two interspaces, and may even extend upon the disc of the wing itself. The anal lunule is a part of the s. t. line, and that may be white marked in other parts of its course. The ordinary lines are traceable as smoky lines, the terminal line black, usually punctiform, but sometimes partly continuous. Orbicular wanting, reniform, partly outlined. Secondaries smoky brown, almost blackish, fringes paler. Beneath, primaries blackish, the white blotches of the upper side vaguely yellowish; secondaries whitish, with a broad dark outer border and a more or less obvious blackish median band. Abdomen gray.

Expands: .80-.92 inches = 20-23 mm.

*Habitat*.—Baboquavaria Mts., Pima County, Arizona, July, 15-30; O. C. Poling; Yuma County, Arizona, Hutson.



Eight examples, mostly in good condition and all females. Two specimens came through Dr. Barnes; the others are from Mr. Poling directly, or from Mr. Hutson. At first sight the specimens resemble *quadriplaga*; but the dark secondaries and the maculation of the fringes negated that reference. I am not so sure now that this is not simply the female of *pima* and that the somewhat imperfect specimen that I have associated with the male type does not belong elsewhere. I have no other example, however, of white secondaries and abdomen in the male as against gray in the female, and no such uniform difference in the costal margin. I prefer to give the name, therefore, to call attention to the matter.

***Acontia alata*, new species.**

Head, collar and thorax laterally white; thoracic disc grayish olive with a white central line or broader mark. Primaries dark, even olive gray, costa white nearly to the apex; a white stripe from base below median vein to about the center of the wing, then curved upward and extending obliquely to the costa within the apex. The entire region above this white stripe is more or less white marked. There is a narrow white terminal line and the tips of the fringes are whitish, secondaries smoky yellowish, the fringes paler. Beneath, primaries even, glistening dark gray, secondaries whitish.

Expands: .65-.70 inches = 15-16 mm.

*Habitat*. — Baboquivaria Mts., Pima County, Arizona, July 15-30; O. C. Poling.

Three males and one female, all in good condition; one ♂ from Dr. Barnes, whose label reads "Babaquivera," the others from Mr. Poling direct. The species is altogether unlike any other *Acontia* and is more like *Thalpochares* in appearance, if not in structure. The front is cylindrically protuberant.

***Acontia eudryada*, new species.**

Head, thorax and abdomen white. Primaries white to the outer third at inner margin, and from that point a gray and olivaceous shade extends with an outcurve to the apex, narrowing so as to include only the s. t. space, leaving the terminal space white until just before the apex is reached. At base there is a slate gray costal shade to show the inception of a t. a. line. At middle there is a small trigonate cloud. The outer shading has a golden yellow tinge at the inner edge, and an angulated metallic blue line which extends as a powdering to the apex. Secondaries blackish, paler at base; fringe whitish. Beneath, primaries black clouded; secondaries whitish.

Expands: 1.05 inches = 26 mm.

*Habitat*. — Southern Arizona, August 15-30, Mr. O. C. Poling.

One female specimen, almost perfect. Is allied to *cretata* but larger, with a much narrower outer band and blackish secondaries. It is to my mind the handsomest species in this attractive genus.

***Acontia cuta*, new species.**

Head, thorax and abdomen white, the latter with a creamy tinge. Primaries white to the middle, beyond which it is gray except for a lunate mark on the costa. This lunate mark is separated from the white base by an inwardly oblique band of gray, and does not extend to the apex. A white patch in the fringes of outer margin at about the middle. The orbicular is round, of moderate size, concolorous, narrowly brown ringed. Secondaries whitish. Beneath, primaries yellowish, with maculation of upper surface showing faintly. Secondaries whitish.

Expands: .75 inch = 19 mm.

*Habitat*.—Santa Rita Mts., Pima County, Arizona, Dr. Barnes; Baboquivaria Mts., July 15–30, O. C. Poling.

Three female specimens in fair condition. A very simply marked form of the *elegantula* type.

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**A NEW ONCOCNEMIS FROM NEVADA.**

By HARRISON G. DYAR, PH.D.,  
WASHINGTON, D. C.

***Oncocnemis bakeri*, new species.**

Head brown, collar gray, nearly white at tip; thorax dark gray, abdomen lighter. Forewings gray, powdery, hoary, smoother and brownish terminally. Basal line black, small, slender; t.-a. and t.-p. lines single, black, the t.-a. line slightly arcuate, a little widened on costa, t.-p. line strongly excurved over cell, else nearly regular. Subterminal line lost; orbicular and reniform concolorous, in a scarcely perceptible brownish tint, finely black-ringed and narrowly whitish within this edging; claviform indicated. Hind wing translucent white, smoky tinged on veins outwardly and on extreme margin. Below pale, forewing with a black dash representing the inception of the t.-p. line on the costa. Expanse 28–32 mm.

One ♂ and one ♀, Ormsby County, Nevada (C. F. Baker).

*Type*.—No. 7,777, U. S. National Museum.

It resembles *figurata* Harvey and *simplicia* Smith (the latter is not before me).

**Class I, HEXAPODA.****ORDER XI, ORTHOPTERA.****A NEW BACUNCULUS FROM INDIANA.**

By A. N. CAUDELL,

WASHINGTON, D. C.

***Bacunculus blatchleyi*, new species.**

Body moderately slender, noticeably heavier than that of *B. tenuescens*. Head smooth, subquadrate, in neither sex so strongly swollen anteriorly as in *B. tenuescens* and no more than twice as long as broad; attached subhorizontally to the pronotum. Pronotum about one fifth as long as the mesonotum, which is a little longer than the metanotum, the moderately distinct intermediary segment included. Abdomen of the male scarcely inflated apically, the seventh and eighth segments subequal in length, each a little shorter than the ninth. Supra-anal plate small, triangular. Cerci of female rounded and as long as the terminal segment of the abdomen, being about seven or eight times as long as the basal width, straight and quite uniformly tapering; cerci of male cylindrical, scarcely at all tapering, curved downward and inwards crossing each other as usual in both *Diapheromera* and *Bacunculus*; armed on the inner side at the base with a distinct but blunt projection, or spine. Operculum of male as in *tenuescens* but slightly more massive. Legs heavier and less attenuate than in *tenuescens*, the middle femora of the male distinctly heavier and thicker than the posterior ones and armed below near the apex with a stout, blunt curved spine; middle femora of the female with a small spine near the apex below, otherwise the legs of both sexes are unarmed.

Color probably brown to green, or yellowish green. The specimens before me were preserved in spirits and the colors are probably considerably changed.

Length, head, male, 3 mm., female, 4 mm.; pronotum, male, 2.5 mm., female, 3.25 mm.; mesonotum, male, 13 mm., female, 16 mm.; metanotum, male, 12 mm., female, 12 mm.; fore femora, male, 2 mm., female, 16 mm.; middle femora, male, 15 mm., female, 13 mm.; hind femora, male, 20 mm., female, 18 mm.; cerci, female, 3.75 mm.

One male, one female, Starke Co., Indiana (Blatchley).

Type No. 9099 U. S. Nat. Museum.

The females of this species are scarcely separable from those of *Diapheromera veliei* when unassociated with the opposite sex.

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EDITORIAL.

The following contribution to the discussion of the subject of generic types has been sent to us by Mr. Louis B. Prout, of London, England, and refers to the discussion in the June, 1904, number of this Journal:

“Permit me to suggest that if the editor’s views and those of Prof. J. B. Smith, as there set forth, be combined, with the elimination of all elements of personal preference, etc. (which you will agree with me, are the causes of instability and of discord), we shall have an almost perfect system, and one that — as it would work well-nigh automatically — we should all do well to adopt. Evidently adherence to an original spelling would be undoubtedly ‘automatic’; I rejoice to see that you very nearly advocate this, and if I read you aright you are not even *hopelessly* antagonistic to the non-Latin ‘w’ in dedicatory names. Why should *Walkeria* or *Walsinghamia* be disguised by an initial U or V? Surely we in England must not advocate such a proceeding, when our national coinage is perpetuating the barbarous ‘Edwardus’! As to the ‘k,’ you are of course right, and Sir George Hampson’s change to ‘c’ indefensible. Better reject dedicatory names *in toto* than mutilate them beyond recognition.

“The inconsistency of demanding *verbal* definition you have admirably exposed, as also previously in Trans. Am. ent. soc., xxiv, 6. Rothschild and Jordan have made a pretty business of it in

their otherwise masterly 'Revision of the Sphingidæ.' They first reject all genera that are not diagnosed; next they reject all diagnoses prior to their own (*e. g.*, citing as 'type' a species which absolutely contradicts the old diagnosis); why are they not logical enough to end by rejecting all generic *names* 'prior to their own'?

"This brings me to the last, and most important point, the defence, by certain lepidopterists, of the illegal practice of making the first species of a genus the 'type,' irrespective of historical action. I know of no code which permits such a course, and am at a loss to know what right we lepidopterists have to be 'a law unto ourselves' in so vital a matter; the general zoological rules must be our guide. Of course, if we are willing to trample on diagnoses and on common sense, and to make *prasinana* the type of *Tortrix* and so on, the method will be automatic, and therefore in a sense useful; but if we apply it reasonably — as even Sir George Hampson advocates — it is no more automatic than the legal method, properly understood and applied. Perhaps you have overlooked the fact that the different results arrived at by different workers professing to follow the 'elimination' method are mainly due to their having tried to follow the indefensible and impossible applications of it which have unfortunately stultified the results in Scudder's otherwise magnificent 'Historical sketch'; *i. e.*, they have allowed one name, independently erected, to 'restrict' another — whereof the second author had probably never even heard! — have forbidden an author or reviser to fix as type of one genus a species which has earlier been made (or which even now becomes, on their arbitrary methods) the type of another, and have brought in other extraneous elements which have resulted, as Sir George Hampson has so well said, in a 'reductio ad absurdum.' If the history of each name were traced independently and types fixed in accordance, the matter would be greatly simplified. Compare Walsingham and Durrant's 'Merton Rules,' No. 44: 'He who first restricts a genus under its own name limits the possible type,' etc. There is nothing 'absurd' in this, quite the reverse; for it recognizes and respects an intention to revise antecedent work, and fulfils the requirements of the 'British Association' and other codes. Theoretically, no author ought to revise nomenclature without knowing his literature (of course mere faunistic lists can be ignored as they have no restrictive influence); but even if, as you suggest, some reference were overlooked by the monographer, it would not dislocate an entire

cantention of names, as on the Scudder system, but, at the worst, only the one, or ones, immediately involved. A moment's thought will show that, given the literature of a certain name, the type can be decided as automatically, and almost as quickly as, and certainly far more logically than, by the arbitrary selection of the first species—a method which I cannot agree with you is at all likely to obtain in the long run, in face of the strong arguments which were adduced against it by nearly all the authorities who took part in the Sir George Hampson Nomenclature Correspondence (Proc. Internat. Congr. Zool., App. A, Cambridge, 1898) and of the fact that in this matter we ought to work harmoniously with other zoölogists, who can hardly be expected to consent to a course which would bring about such disastrous results in their particular departments."

LOUIS B. PROUT.

LONDON, N. E., 18 Nov., 1904.

Our correspondent advocates what Rothschild and Jordan call the "First method of restriction," or the method of nomination of types.\* We admit that we have not seen this method fairly tried, though we had thought the same objections applicable to it as to the other "historical method," the second method of restriction of Rothschild and Jordan, or the method of residues. These methods are sometimes thought to be similar or parts of one method, but, as Rothschild and Jordan say: "As the first and second methods are opposed to one another, differing nearly always in the results attained, we reject them both." Of course it does not necessarily follow that a method should be rejected because opposed to another; that might prove it the right one. But we are pleased to see that Mr. Prout condemns the method of residues. This is the method heretofore used by Lepidopterists from Scudder to Kirby. It must be abandoned. What method shall we substitute? Mr. Prout urges conformity with other zoölogists; but we have yet to see a code of rules that clearly covers the points of the present subject.

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\* Called by Kirkaldy "The historical method" and advocated by him. (Proc. ent. soc. Wash., vii, 1905.)

## BOOK NOTICES.

*An Outline of the Theory of Organic Evolution*, with a description of some of the phenomena which it explains. By MAYNARD M. METCALF, Ph.D., Professor of Biology in the Woman's College of Baltimore. New York, The Macmillan Company, 1904.

Professor Metcalf presents his subject in a compact and readable style with numerous illustrations. Several color plates of moths, butterflies and spiders give a good idea of the "mimicry" which is so well shown by these insects. The book has resulted from a course of lectures and is therefore well adapted for students.

*American Insects*. By VERNON L. KELLOGG, Professor of Entomology and Lecturer on Bionomics in Leland Stanford Jr. University, with many original illustrations by MARY WELLMAN. New York, Henry Holt and Company, 1905.

This bulky volume of 674 pages gives a general outline of all American insects and deals more largely with anatomy than is usually the case with books of this class. The classification is after Comstock and the synoptic tables are largely remodeled after his. The work is adapted only for beginners or general students (if there are any such) and does not lead to specific determinations. It is almost up to date, including a chapter on mosquitoes and disease. It ends with an account of collecting and rearing insects, which one would fancy must be a laborious undertaking from the amount of apparatus illustrated. Jelly tumblers have always served for us.

*Wilhelm Junk Entomologen-Adressbuch*. Preis Mark 5. W. JUNK, Verlag für Entomologie. Berlin, 1905, NW., Rathenower Strasse 22.

Another entomological address book is before us, well printed and in convenient, compact form. We notice some names not in other similar works which is commendable. There are also some curious errors. For instance, Mr. Geo. Franck, whose name will be found in our list of members published with the June issue of this Journal, appears under the pseudonym of "Iranck," both in text and index. It would be an advantage if publishers of address books could combine on one really good book instead of scattering their efforts as at present.

*The Naturalist's Universal Directory*, containing names, addresses and special subjects of study of professional and amateur naturalists in all parts of the world. 19th edition, compiled in 1904. Salem, Mass., U. S. A., Samuel Edson Cassino, 1905.

With every edition this work becomes bulkier and of less service to naturalists. We note the omission of the names of entomologists (our own, for instance) and the inclusion of those of collectors of stamps and coins. While not objecting to these, at least harmless pursuits, we fail to see the propriety of including them as "naturalists." Certainly the directory does not need them; there are enough names. But why all these separate directories? We shall need a directory of directories shortly.

*A Synonymic Catalogue of the North American Rhopalocera*. Supplement No. 1. By HENRY SKINNER, M.D. Philadelphia. Complete to end of 1904. [Received Sept. 14, 1905.]

Dr. Skinner has given us a very useful little supplement to his catalogue of butterflies. It is somewhat bristling with typographical errors and blunders, but we are used to that sort of thing from Philadelphia. There are some comments, indicating new synonymy and one new name (varietal) is proposed. The number of species added to our list is not large. The generic names have not been brought up to date, the author expressly stating that he is "not interested" in the subject, which he is pleased to designate as "generic fantasies." This is, we think, a fault. It is easy to stigmatize what one will not take the trouble to understand; but a good opportunity of correcting the antiquated nomenclature of the North American butterflies has here been lost.

## PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF DECEMBER 6, 1904 (continued from page 168).

Mr. Bueno said further that in the works on American Entomology to which he had access, the family Gelastocoridæ Kirk. (Galgulidæ) was given as being represented by only three species in the United States. He has, however, a list of nine species, in four genera, as follows: *Pelagonus americanus* Uhler, *Gelastocoris oculatus* Fabr., *G. variegatus*, *G. vicinus* Mont. and *G. n. sp.?* from Florida, *Mononyx nepæformis* Fab., *M. fuscipes* Guér. and *M. n. sp.?* also from Florida, *Nerthra stygica* Say.



## MEETING OF DECEMBER 20, 1904.

Held at the American Museum of Natural History. President C. H. Roberts presided with thirteen members present.

The librarian, Mr. Schaeffer, reported the receipt of the following exchanges: Verhandl. k. k. zool. bot. Gesells., Vol. LIII, No. 10; Vol. LIV, Nos. 1, 2, 3,

4, 5, 6 and 7.

Ohio Naturalist, Vol. IV, Nos. 4, 5, 6, 7 and 8.

Tijdschrift voor Entomologie, 1904, No. 1.

Entomologische Meddelser, 1903, 1904, No. 1, 5 and 6.

Proc. Amer. Acad. of Arts and Sciences, Vol. XXXIX, Nos. 15, 16, 17, 18, 19, 20, 21, 22, 23, 24; Vol. XL, Nos. 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Bull. Univ. Montana, No. 8, Biol. Series, No. 6.

Bull. Univ. Montana, Nos. 20 and 23.

Bull. Univ. Texas, Nos. 33 and 34.

Philos. Soc. Washington, Vol. XIV, pp. 247-276.

Buletino della Soc. Ent. Italiana, XXXV-I and II, III and IV.

Cincinnati Museum Association, 23 Ann. report.

Proc. Amer. Phil. Soc., XLII, No. 174; XLIII, No. 176.

Trans. Canad. Institute, II, p. 3.

Deutsche Ent. Zeitschrift, 1904, Heft 1 and 2.

Fourteenth Jahres-Bericht d. Wiener Ent. Vereines., 1903.

Stettiner Ent. Zeitung., 65 Jahrgang, Heft 1 and 2.

Proc. U. S. Nat. Mus., Nos. 1371, 1375, 1376, 1378, 1382, 1387, and 1389.

Canadian Entom., XXXVI, Nos. 4, 5, 6, 7, 9, 10, 11.

No. Carolina, Dept. of Agric. Div. of Ent. — The San Jose scale by Franklin Sherman.

Jahresbericht des Naturwissenschaftlichen Vereins des Trencsener comitates for 1902 and 1903.

Bull. Soc. imperiale des Naturalists de Moscow, 1904, No. 1; 1903, Nos. 2 and 3.

Zeitschrift f. Entomologie; Breslau, 1904, Heft 29.

Allgemeine Zeitschrift f. Entomologie, Vol. VIII, Nos. 16-24; Vol. IX, Nos. 1-20.

Researches on N. Amer. Acrididæ by A. P. Morse, Carnegie Instit., Washington, D. C., 1904.

Wiener Ent. Zeit., XXIII, Nos. 2, 3, 4, 5, 6.

Journal of Dept. Agric. of Victoria, Australia, Vol. II, Pts. 3, 4, 5, 6 and 7.

Bull. Agric. Victoria, Australia, Nos. 7 and 12.

Annales del Mus. Nac. de Buenos Aires, Ser. III, Tome II and III.

Ann. Soc. Ent. Belgique, XLVII, 1903.

Trans. Texas Acad. Sciences, V, 1902.

Mr. Leng, of the publication committee, read a letter from Dr. Dyar which constituted the report of the committee.

Dr. Love stated that as it did not seem advisable to hold a banquet this year he would desire that the committee be discharged, and made a motion to that effect which was carried.

The President appointed as a committee to nominate officers to be ballotted upon at the next meeting, Messrs. Love, Southwick and Watson.

Mr. Weeks advocated the printing in each issue of the JOURNAL a list of the members of the New York and Brooklyn societies and read a communication which he had received from Dr. Dyar in reference to the matter.

On motion of Mr. Leng the matter was referred to a committee to investigate the cost of printing such a list and to endeavor, if they saw fit, to raise the funds by subscription.

Messrs. Leng, Weeks and Joutel were appointed on this committee.

Mr. Groth stated that he desired taken from the table a former tabled motion of his, that the Journal be furnished free to active members in good standing.

The discussion was participated in by nearly all of those in attendance, and upon vote the motion was lost.

Mr. Leng spoke of the species of *Cychnus* inhabiting the eastern United States. After briefly describing the habits of this genus of Carabidæ as living under logs and stones and feeding on snails, and the striking characteristics of the species, their large size, brilliant color, unusual development of the palpi and mouth parts; he mentioned the special interest recently awakened in these insects by the collections made in the mountains of North Carolina by Beutenmüller, Beyer, Schaeffer and Van Dyke; and in Newfoundland by Genung, in West Virginia by Dr. Love and himself; in Missouri by Mr. Barber, and in the southwest by Prof. Snow; in the District of Columbia by Mr. Schumacker, and on Manhattan Island by Messrs. Davis and Joutel. The point to which Mr. Leng drew special attention was the meaning of certain names now lost in synonymy which should be revived before more names are added. Twenty-seven names have so far been proposed, of which fourteen appear in the check-list and two have been proposed since the check-list was printed; leaving eleven at present in synonymy. Some of these eleven were indicated as geographical races in the collection shown by Mr. Leng, notably the following:

*C. flammeus* Hald. which is the broader form of *elevatus* occurring in Missouri.

*C. leonardi* Harris which is the smaller form of *viduus* occurring in the mountainous regions of New Hampshire and New York.

*C. niagarensis* which is probably the correct name to apply to those specimens from the middle states commonly called *lecontei*.

All of the names remaining in synonymy should be critically examined and accurately placed.

Messrs. Schaeffer, Joutel and other members took part in the discussion that followed. Mr. Joutel pointed out the character he had observed in all specimens of *unicolor* Oliv., viz.: a sinuation of the elytral margin about the posterior third. The synonymy of *unicolor* and *heros* was also brought out, *unicolor* being the older name. Mr. Schaeffer spoke of *bicarinatus* as found in the Black Mts. and the differences between such specimens and the type from Habersham Co., Ga. Mr. Leng, in reply to a question, expressed the opinion that all our eastern species are reducible to three original species from which the existing forms have been evolved by the influence of isolation as indicated by Newman's division into three subgenera, *Spharoderus*, *Scaphinotus* and *Irichroa*.

Mr. Southwick on the subject of "Notes on Local Bythoscopidæ and Cercopidæ"

exhibited many of the eastern species of these two families, gave a list and commented on a number of species especially those of economic importance.

#### MEETING OF JANUARY 3, 1905.

Held at the American Museum of Natural History. President C. H. Roberts in the chair and ten members present.

The treasurer, Mr. Davis, made his annual report showing that the society had a balance of \$599.04, the Journal fund, \$235.66. Total balance January 1, 1905 was \$834.70.

Dr. Dyar of the publication committee gave a report in which as editor of the Journal he offered several suggestions in reference to conducting the current volume in order to cut down the expense.

Mr. Watson read the nominations of officers for the ensuing year as follows :

*President* — C. H. Roberts.

*Vice-President* — C. W. Leng.

*Recording and Corresponding Secretary* — H. G. Barber.

*Treasurer* — Wm. T. Davis.

*Librarian* — C. Schaeffer.

*Executive Committee* — E. B. Southwick, L. H. Joutel, F. E. Watson, G. Beyer, C. F. Groth.

*Publication Committee* — H. G. Dyar, C. W. Leng, C. Schaeffer, C. T. Brues.

On motion of Mr. Kearfott the secretary cast one ballot for the entire ticket as nominated.

On motion of Mr. Weeks the society voted to discontinue sending postal card notices of future society meetings.

Mr. Roberts exhibited a collection representing the genus *Dytiscus* and made some remarks on the different species.

#### MEETING OF JANUARY 17, 1905.

Held at the American Museum of Natural History. President C. H. Roberts presided with nine members present.

The auditing committee reported that the accounts of the treasurer had been examined and certified as correct.

On motion, Mr. R. L. Ditmars and A. H. Weeks were dropped from membership for non-payment of dues.

The secretary read a communication from Mr. J. R. de la Torre Bueno requesting a grant from the Hermann fund to carry on an investigation of the Cryptocerate Hemiptera. The matter was referred to the executive committee.

Mr. Davis exhibited several specimens of *Gordius* worms parasitic in the bodies of various insects. One of these had been taken from the body of a caterpillar (*Hemileuca maia*). The other, 28 inches in length, came from a body of *Dytiscus* beetle.

Mr. Barber exhibited a collection of Hemiptera consisting of the families Coreidae, Pyrrhocoridae, and Lygaeidae, collected by Mr. Schaeffer at Brownsville, Texas and gave some notes on the geographical range of these.

Mr. Schaeffer showed some of the rarer Coccinellidae.

The members discussed at some length *Ignotus enigmaticus* Slosson.

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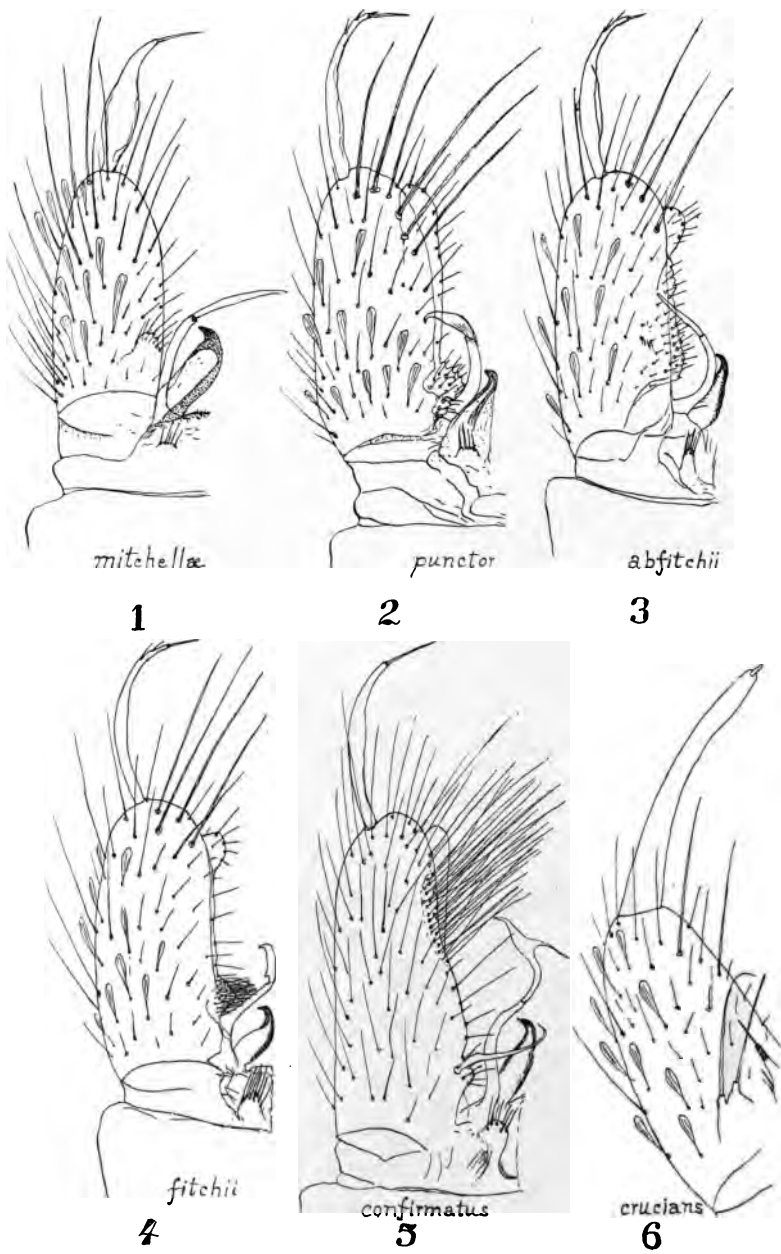
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## ERRATA ET ADDENDA.

- Page 145, lines 8 and 25, for "*shooteri*" read *shooterii*.  
Page 151, last line, add Type No. 8327, U. S. National Museum.  
Page 152, line 20, for "Rhyncholographieen," etc., read Rhynchotographieen  
Abh. Vöhm. Ges. Wiss. (5), vol. vii, p. 479.  
Page 155, line 35, for "Maxicuche" read Maxincuche.  
Page 158, line 28, *dele* "Fort Collins, Colorado."  
Page 159, line 15, add "Ms."  
Page 160, line 22, for "Lieb." read Fieb.



Genitalia of Mosquitoes.



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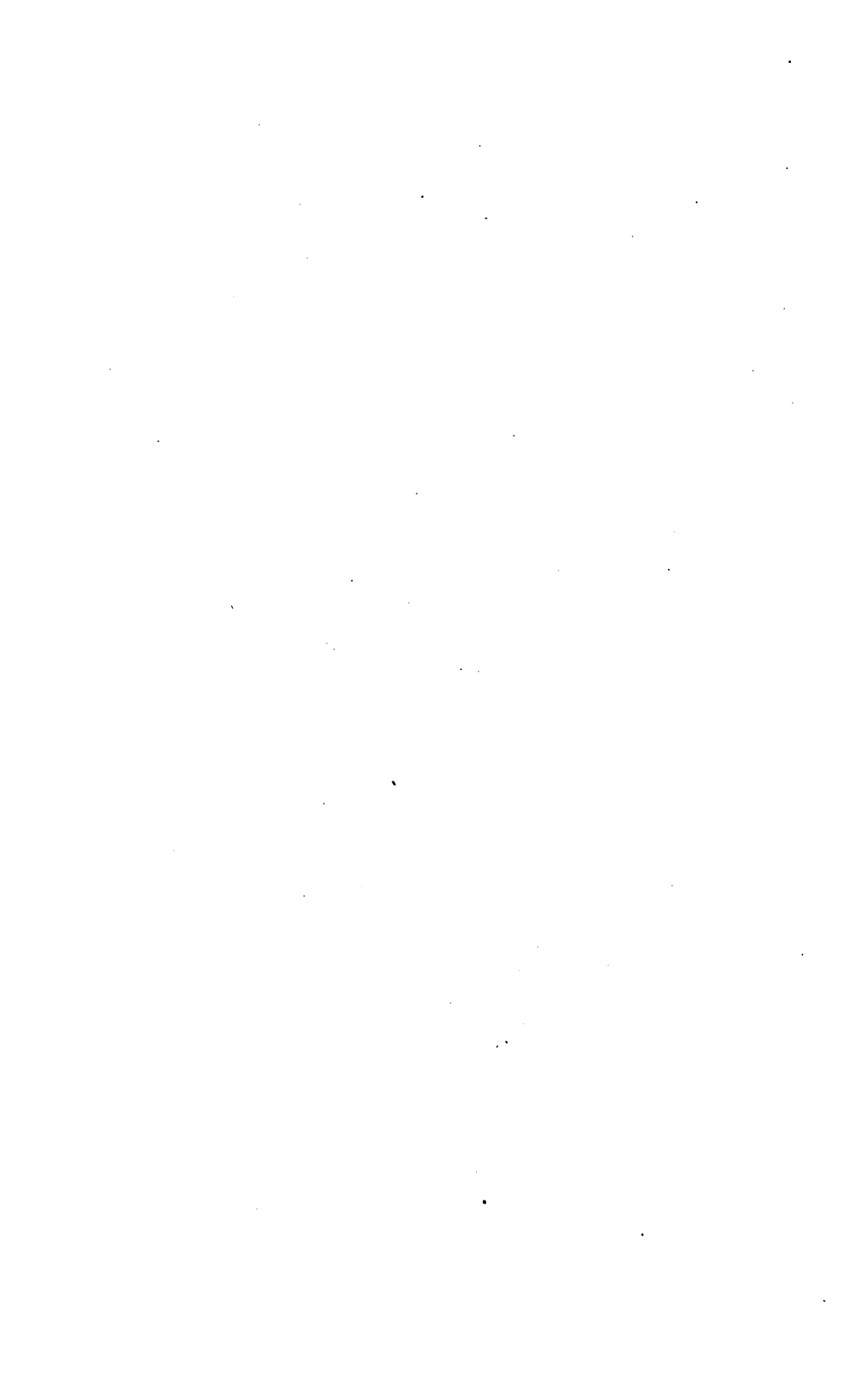
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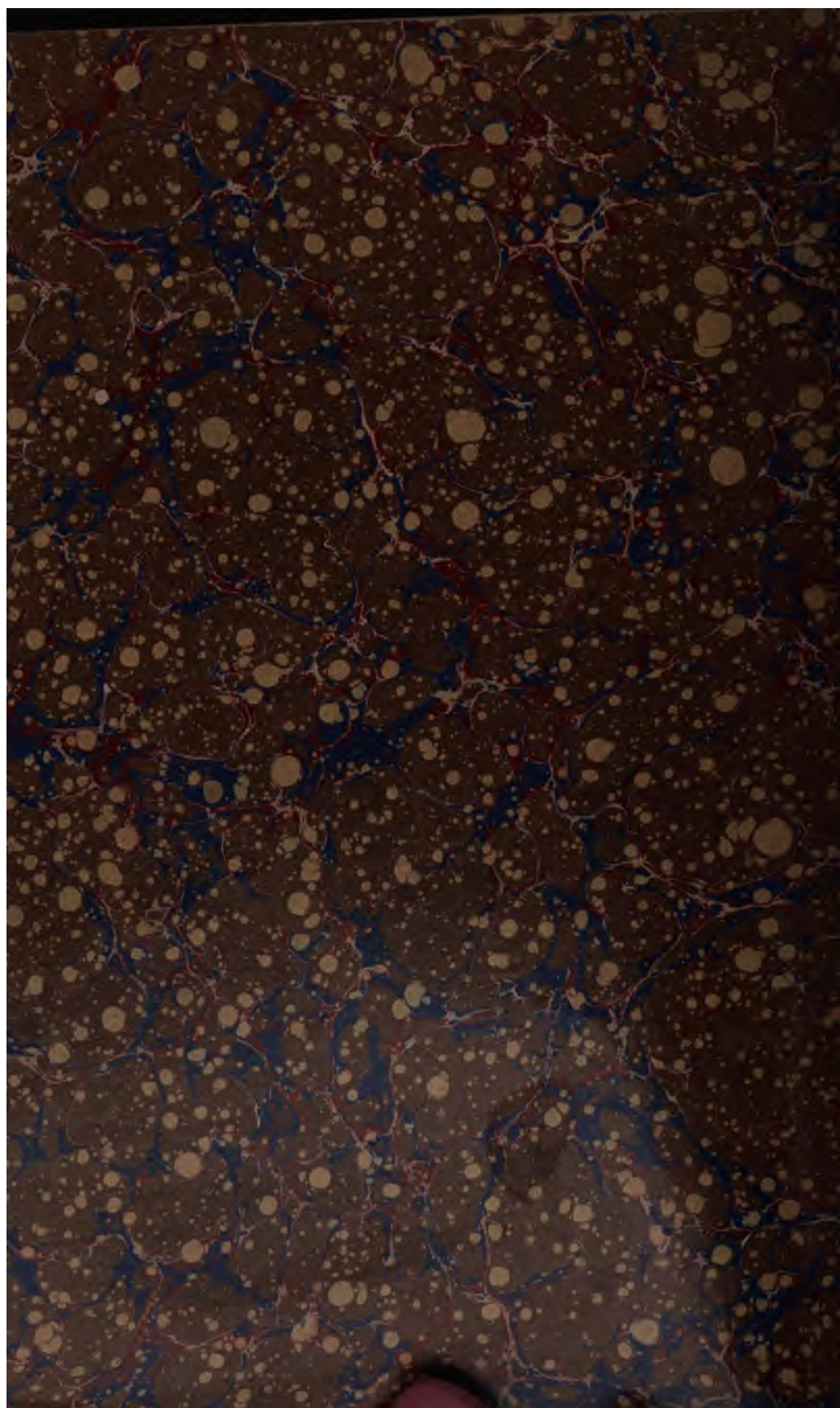




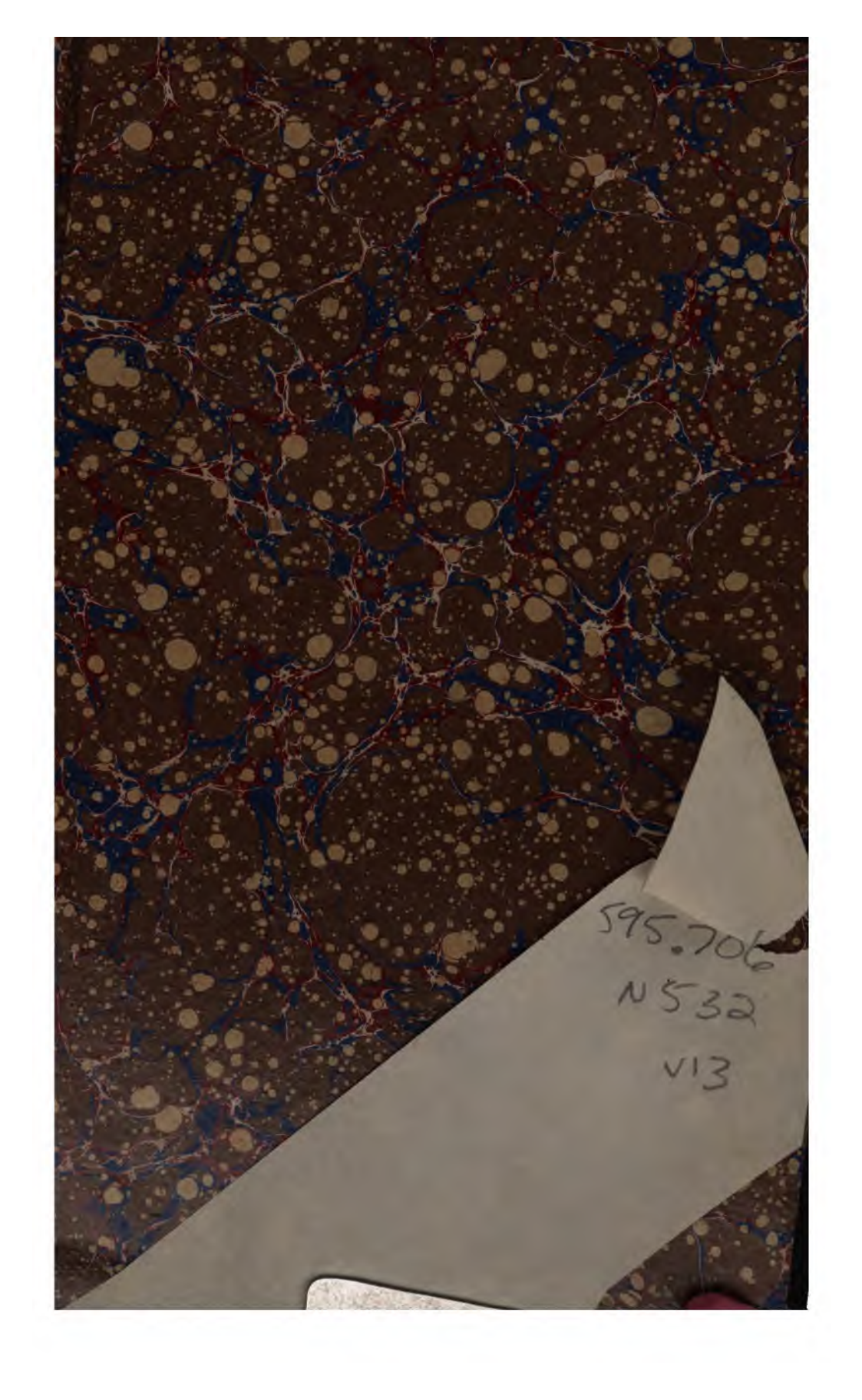










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